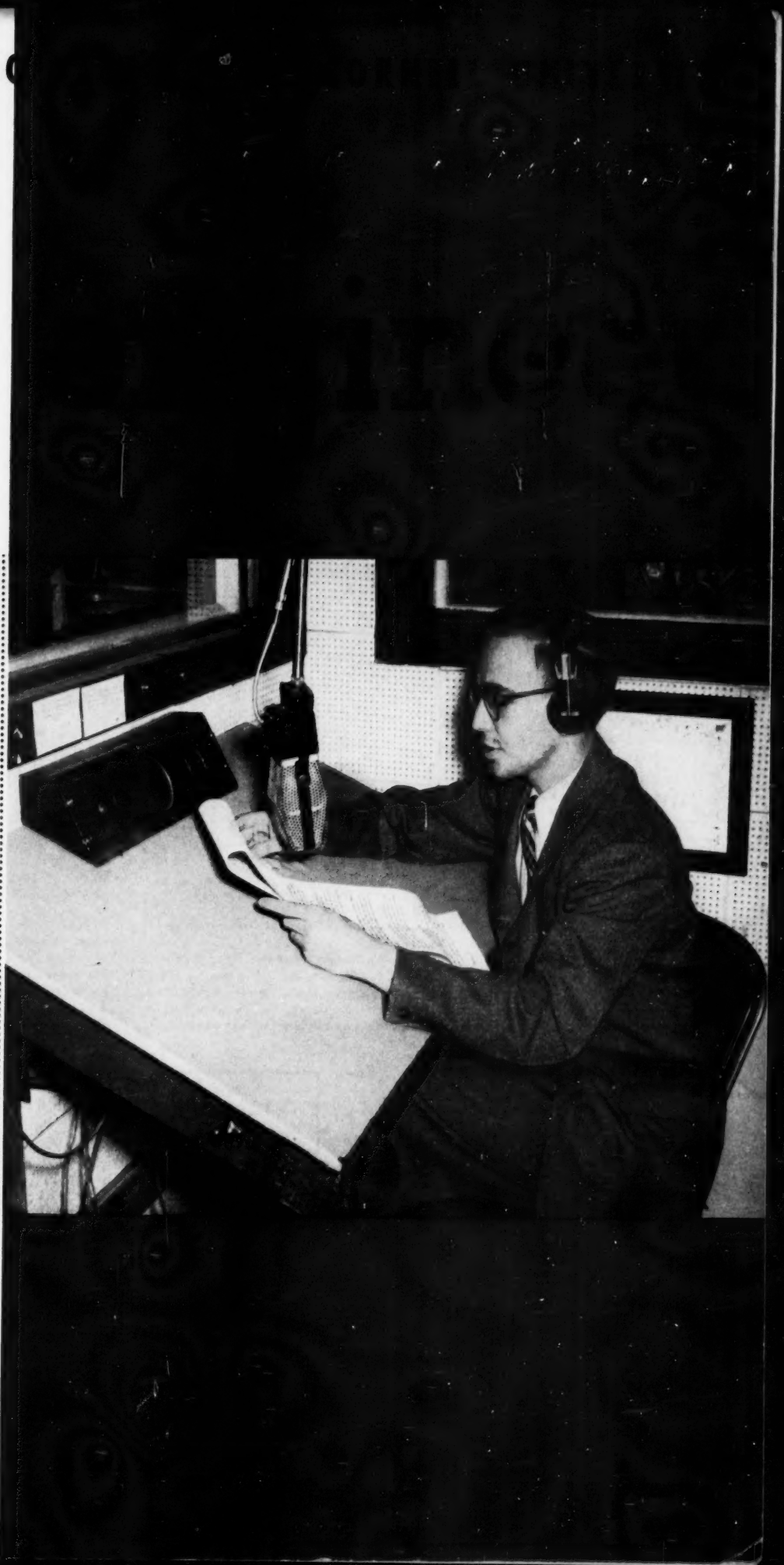
COLLEGE OF ENG

the Cornell

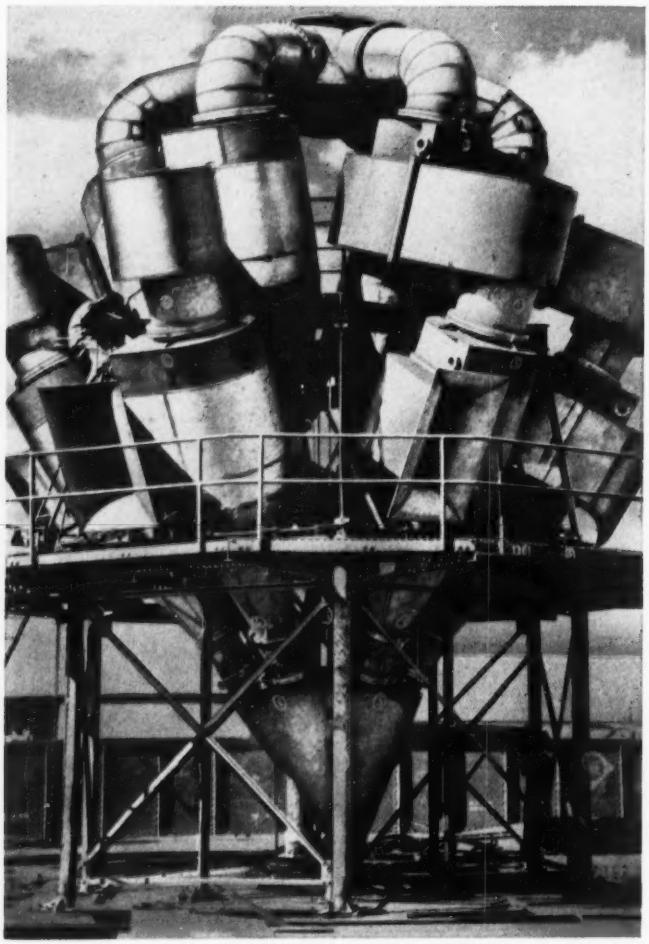


APRIL, 1954

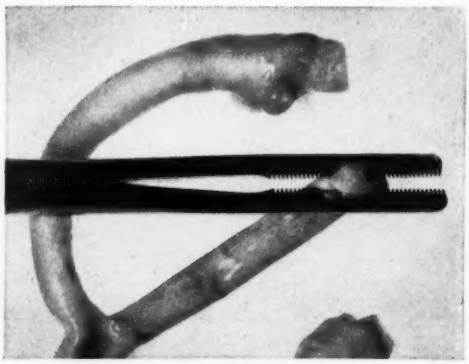
VOL. 19, NO. 7

25 CENTS

Only STEEL can do so many jobs so well



Visitor from Outer Space? No, despite its strange, other-worldly appearance, this is no product of extra-terrestrial intelligence, no flying saucer. It's a perfectly practical, very down-to-earth catalyst collector in a large petroleum refinery. Noteworthy, however, is the extensive use of USS Stainless Steel in its fabrication . . . to provide corrosion resistance combined with great strength.



Amputations Reduced. This new surgical clamp, hand-made of sanitary corrosion-resistant Stainless Steel, can grasp a human blood vessel or artery firmly during a delicate operation without injuring the vessel wall. This stainless steel clamp has helped to reduce substantially the number of amputations resulting from war wounds.

Handkerchief Test proves that you can't beat this drum for cleanliness! Rub a clean handkerchief briskly around the inside of a USS Drum. The handkerchief *stays* clean. No grease, dirt, scale or rust show up to contaminate drum contents. Why? Because of a new U.S. Steel process that results in drums absolutely clean, completely scale-free, fully rust inhibited.

MANUFACTURED FROM USS STEEL UNITED STATES STEEL

This trade-mark is your guide to quality steel

OPPORTUNITIES WITH U. S. STEEL

If you're thinking about what you're going to do after graduation . . . if you're interested in a challenging, rewarding position with a progressive company . . . then it will pay you to look into the opportunities with United States Steel. Your placement director can give you more details, or we'll be glad to send you the informative booklet, "Paths of Opportunity." United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL

For further information on any product mentioned in this advertisement, write United States Steel, 525 William Penn Place, Pittsburgh, Pa.

AMERICAN BRIDGE . . AMERICAN STEEL & WIRE and CYCLONE FENCE . . COLUMBIA-GENEVA STEEL . . CONSOLIDATED WESTERN STEEL . . GERRARD STEEL STRAPPING . . NATIONAL TUBE
OIL WELL SUPPLY . . TENNESSEE COAL & IRON . . UNITED STATES STEEL PRODUCTS . . UNITED STATES STEEL SUPPLY . . *Divisions of* UNITED STATES STEEL CORPORATION, PITTSBURGH
UNITED STATES STEEL HOMES, INC. • UNION SUPPLY COMPANY • UNITED STATES STEEL EXPORT COMPANY • UNIVERSAL ATLAS CEMENT COMPANY 4-622

THIS IS SYLVANIA...

BIG ...*diversified*... GROWING

THE IDEAL ENVIRONMENT FOR YOUNG ENGINEERS

In 1953, Sylvania's 40 plants in eleven states produced upwards of $300 million worth of products in more than sixty categories of lighting, radio, television and electronics equipment.

This year will see the completion of additional new plants and laboratories, as another phase of a continuing expansion program which has doubled plant and equipment in the past few years.

As a graduate engineer, you'll naturally find a wide range of opportunities in every phase of engineering at Sylvania. And you'll find yourself making rapid headway as the company continues to add new facilities, new fields.

A stimulating atmosphere of accomplishment and opportunity — plus size, growth, and diversity — make Sylvania, a company of young men where the executive level averages 45 years of age, an ideal place to build a satisfying career in engineering.

For detailed information, see your College Placement Office or send for our comprehensive brochure, "Today and Tomorrow with Sylvania", by writing to Supervisor of Technical Employment.

SYLVANIA

Sylvania Electric Products Inc.
1740 Broadway, New York 19, N. Y.

LIGHTING • RADIO • ELECTRONICS • TELEVISION

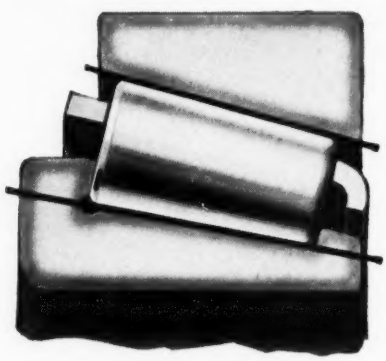
Another page for **YOUR BEARING NOTEBOOK**

Jet's wheel bearings have to take three kinds of forces

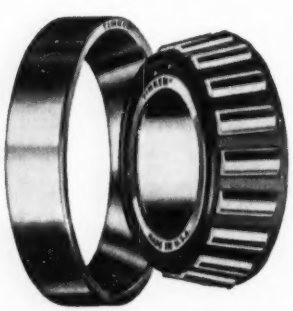
When the F86-D Sabre Jet lands—the wheel bearings take a triple beating. There's the initial landing shock, an almost instantaneous acceleration; and, if there's a crosswind, heavy thrust loads. Bendix and North American solved this triple punch problem by using Timken® tapered roller bearings for all three landing wheels. Their tapered design enables them to take radial and thrust loads in any combination. And Timken bearings' true rolling motion and incredibly smooth surface finish practically eliminate friction permitting rapid acceleration.

Line contact helps TIMKEN® bearings take jet landing load

This cross-section drawing shows one reason Timken bearings are ideal for taking the heavy landing load of the plane itself. Note the full line of contact between rollers and races. This gives Timken bearings high load capacity. It's a basic advantage of roller bearings.



TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



Want to learn more about bearings or job opportunities?

Some of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, Ohio.

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL ◎ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

Boeing eight-jet B-52 global bomber

Which field of engineering interests you most?

Whether it's electrical, civil, mechanical, aeronautical or any related field, you'll find a rewarding career opportunity at Boeing.

Engineers of virtually every type are in increasing demand here—for Boeing is growing continuously, and today employs *more* engineers than even at the peak of World War II. That's the kind of situation in which positions up ahead keep opening up. Boeing fills them from within its own organization, and holds regular merit reviews to give you steady recognition.

As a Boeing engineer you'd be part of a team that, for 37 years, has pioneered successful, trail-blazing types of airplanes. You could look toward a stable future with such long-range Boeing projects as a pilotless aircraft program (one of the largest in the country), development of America's first jet transport, research on supersonic flight and nuclear power for aircraft, and the world's fastest multi-jet bombers, the B-47 and B-52.

You'll find a wide range of experience and contacts available to you at Boeing. The aviation industry is unique in its variety and breadth of application—from applied research to production design, all going on at once. Boeing is constantly alert to new materials and new techniques, and approaches them without limitations. In addition, Boeing's vast subcontracting program—requiring engineering co-ordination—offers an opportunity for contacts with a cross section of American industry.

At Boeing, you'd work in Seattle, Washington, or Wichita, Kansas—two fresh, modern cities with a wide variety of recreational facilities as well as universities which provide excellent graduate study courses. The company will arrange a reduced work week to permit time for such study and will reimburse tuition upon successful completion of each quarter's work.

For full details on career opportunities at Boeing,

consult your PLACEMENT OFFICE, or write

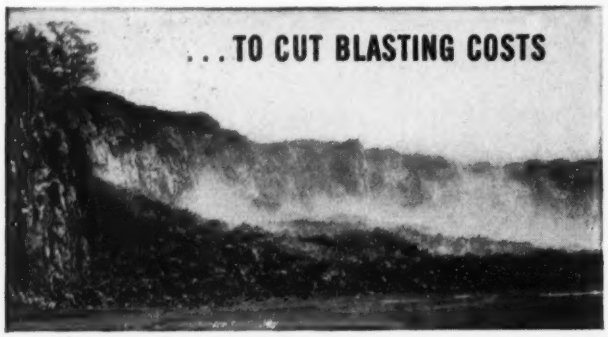
JOHN C. SANDERS, Staff Engineer—Personnel
Boeing Airplane Company, Seattle 14, Washington

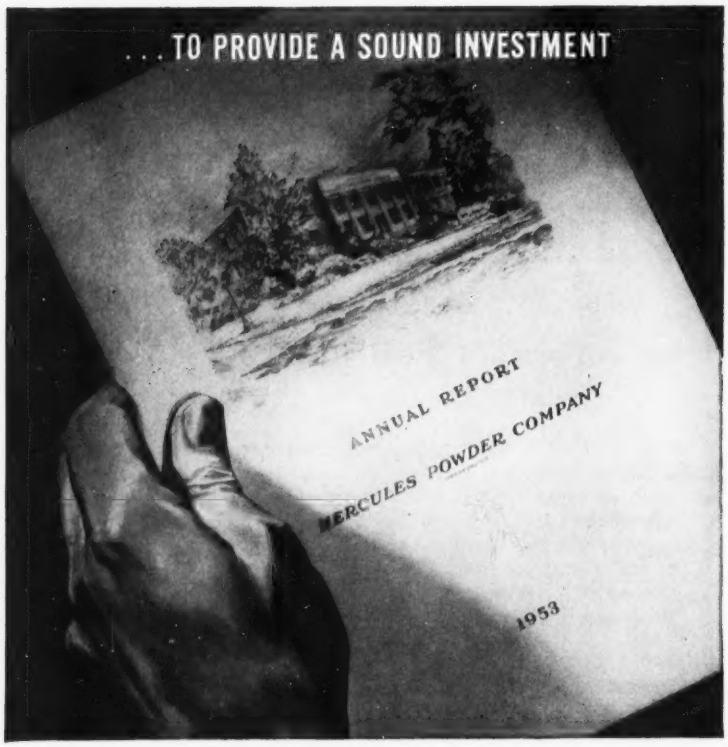
BOEING

HOW HERCULES HELPS...

Hercocel®, a Hercules cellulosic plastic, is durable, lightweight, colorful, and quickly and economically molded into intricate or thin-walled shapes. It is used for hundreds of industrial and consumer products, one of which is Connecticut Telephone & Electric's new interoffice telephone shown here.

In quarrying, as in metal mining, coal mining, and construction, proper blasting with the proper explosives promotes higher production . . . easier work for men and machines. Hercules' 40 years of experience in the development, manufacture, and use of explosives mean top efficiency and economy.





Hercules' business today helps almost everyone's business. It embraces the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules helps improve the processing or performance of many industrial and consumer products.

Hercules' continuing creative research in chemical materials is reflected in an increase in sales from $7,640,741 in 1913 to $190,202,417 in 1953; more than 10,000 employees; and a history of 162 consecutive dividends since Hercules' organization in 1913. Send for your copy of our 1953 annual report.

EC54-3

HERCULES POWDER COMPANY *Wilmington 99, Delaware*

HERCULES

Practically everything but the Elms!

WE can't promise you college scenery at General Motors.

But as a graduate engineer you can find a lot of things at GM to remind you of college days—more important than elms or ivy.

You'll find men to work with and to work under who have as deep a faith in science, and the contributions science can make to human welfare, as your own college professor.

You'll find an atmosphere congenial to the scientific mind as is the atmosphere of your own engineering school.

For General Motors believes that only in this kind of intellectual climate can an engineer function at his best. And thus best help General Motors in its continuing pursuit of more and better things for more people.

Add this to GM's wealth of equipment and resources—our wide variety of engineering activities—and you can see why opportunity at GM is as high, wide and handsome as you have the ability to make it.

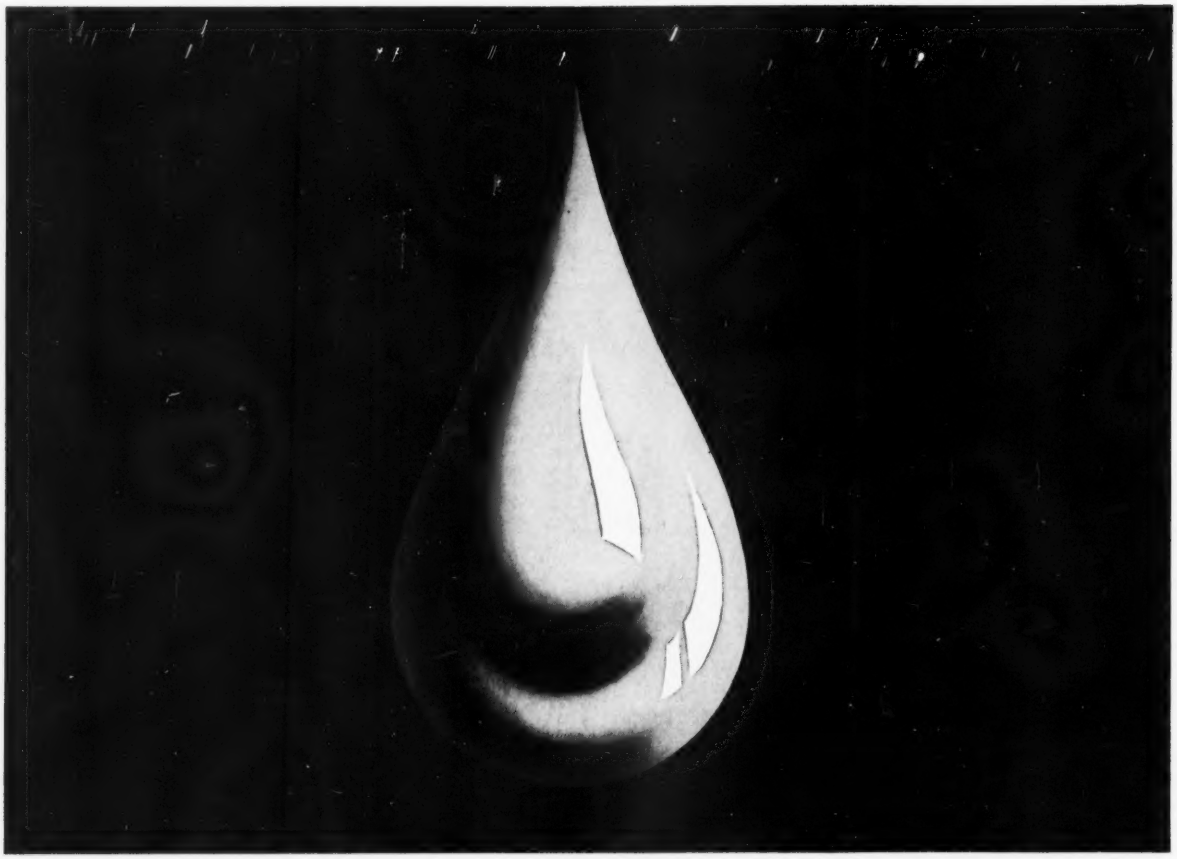
Why not request your College Placement Officer to arrange an interview with our GM College Representative, the next time he visits your campus. Or write us directly.

GM positions now available in these fields

MECHANICAL ENGINEERING
METALLURGICAL ENGINEERING
CHEMICAL ENGINEERING
ELECTRICAL ENGINEERING
INDUSTRIAL ENGINEERING
BUSINESS ADMINISTRATION

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan



MOLECULE MAGIC . . .

This tiny drop of oil, say the chemists, contains hydrocarbons—the raw material for hundreds of thousands of organic chemicals . . . the makings for tires and textiles, for dyes, detergents and deodorants, for paints, plastics and polishes, for agricultural and industrial chemicals.

Oil—the ointment of the ancients and preservative for mummies—is old. It's Nature's billion-year alchemy that changed fish and lizard leftovers into black gold . . . chemical "gold" that is just now being developed.

DREAMLAND IN A DROP . . .

It wasn't until this century that the chemical and petroleum industries began the molecular magic that transformed a drop of oil into a two-and-a-half billion dollar enterprise.

How did it happen? Principally because of the way we Americans work. Every art, science and branch of engineering has the opportunity and the incentive to add its drop of genius to the pool of progress. Here cooperation and competition bring benefits of better living to people everywhere.

And lighting the way toward the brighter future is America's all-seeing, all-hearing and reporting Inter-Communications System.

THE AMERICAN INTER-COM SYSTEM...

Complete communication is the function, the unique contribution of the American business press . . . a great group of specially edited magazines devoted to the specialized work areas of men who want to manage better, research better, sell better, buy better.

COMMUNICATION IS OUR BUSINESS...

Many of the textbooks in which you are now studying the fundamentals of your specialty bear the McGraw-Hill imprint. For McGraw-Hill is the world's largest publisher of scientific and technical works.

After you leave school, you will want to keep abreast of developments in your chosen profession. Then one of McGraw-Hill's many business magazines will provide current information that will help you in your job.

McGRAW-HILL PUBLISHING COMPANY, INC.

ABP 330 WEST 42nd STREET, NEW YORK 36, N. Y. ABC

HEADQUARTERS FOR TECHNICAL AND BUSINESS INFORMATION

McGRAW-HILL FOR BUSINESS

John F. Schmutz ChemE '55
editor-in-chief
Edwin A. Leventhal EP '56
managing editor
Milton Cherkasky ME '55
business manager

◇

Publication Board

Lavonne C. Olson ChemE '57
assistant editor
Thomas C. Reed ME '56
associate editor
Evan M. Zelin EE '57
illustrations editor
William C. Thurber MetE '55
treasurer
Francis B. DeGross ME '57
circulation manager
Leonard Pisnoy CE '57
advertising manager
George Haunalter CE '57
publicity manager
Yale Brazel EE '56
office manager

Founded 1885

THE CORNELL engineer

APRIL, 1954 VOLUME 19 NUMBER 7

Editorial Board

D. G. Douglas CE '56
R. H. Kantor EP '57
J. Max EP '57
F. J. Rosengarten ChemE '57
J. F. Ahearne EP '57
A. H. Vaughan EP '57
R. Brandenburg EP '58

◇

Business Board

J. L. Beckel Arch '56
R. K. Fisher ChemE '57
I. M. Jacobs EE '56
M. D. Payson ME '58
A. P. Perlman CE '58

◇

Illustrations Board

D. Ball CE '55
S. G. W. Beck EE '56
D. Crook Arch '56
R. C. Noyes ME '55
R. L. Simon EE '54
D. R. Schudel ME '57
M. B. Starr EP '57
J. B. Shields Arts '58

◇

Advisory Board

Dean S. C. Hollister

Technical Advisors

Prof. W. H. Erickson
Prof. J. E. Hedrick

School Directors

Prof. C. R. Burrows EE
Prof. N. A. Christensen CE
Prof. F. H. Rhodes ChemE
Prof. L. P. Smith EP
Prof. H. J. Loberg ME

Alumni

H. H. Williams, Jr. C.E.'26
W. H. Hill M.E.'22

Engineers in Civil Defense I 11
by Howard C. Young, M.E. '19

The Automatic Sprinkler 15
by Robert Z. Fowler, EE '54

Retiring Board Members 17

Faculty Profile—Prof. Julian Smith 23

WVBR—Picture Brief 24

President's Page 28

Alumni Engineers 29

College News 32

Technibriefs 36

Electrical Engineers—Class of 1954 42

Civil Engineers—Class of 1954 42

Stress and Strain 48

COVER—Dick Bernhard of **WVBR** broadcasts the news.
—Zelin

Member of The Engineering College Magazines Associated

Chairman: Prof. Thos. Farrell, State University of Iowa, Iowa City, Iowa
Publishers' Representative, Littell-Murray-Barnhill, Inc.
101 Park Ave., New York and 605 N. Michigan Ave., Chicago

Published monthly—October to May—by the CORNELL ENGINEER, Inc., Lincoln Hall, Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under Section 103, Act of October 3, 1917.

Subscription per year: regular $2.00; with membership in the Cornell Society of Engineers $3.00 (See President's page); student $1.50; single copy $.25.

This germanium refining method keeps impurities down to less than 5 parts in a billion

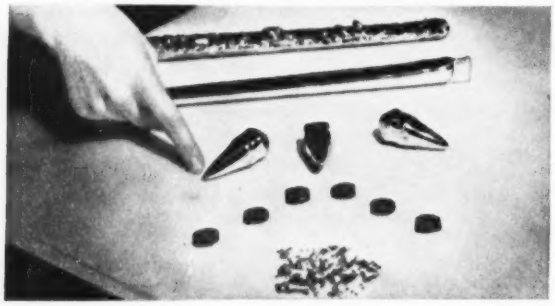
In this refining apparatus, at Western Electric's Allentown, Pa. plant, germanium is passing through multiple heating zones in tandem, producing a bar containing impurities of less than 5 parts in a billion for use in transistors. Note heating coils on the horizontal quartz tube.

A new method of metal refining, currently in use at the Western Electric plant at Allentown, results in the production of germanium that is better than 99.9999995% pure – the highest degree of purity ever attained in a manufactured product.

The need for germanium of such exceptional purity came about when research by Bell Telephone Laboratories in the field of semi-conductors led to the development of transistors, which are manufactured by Western Electric.

The transistor is a tiny crystal device which can amplify and oscillate. It reduces space requirements and power consumption to a minimum.

Various forms which germanium takes before being used in transistors are shown in this photo. Bar at top is an ingot of germanium after reduction from germanium dioxide. Next is shown the germanium ingot after the zone refining process used by Western Electric. Below the ingots are shown 3 germanium crystals grown by machine, 6 slices cut from these crystals, and several hundred germanium wafers ready for assembly into transistors.



Germanium crystals of the size required in transistors do not occur in nature; they are artificially grown at Western Electric. At this stage in transistor manufacture, other elements are introduced in microscopic quantities to aid in controlling the flow of electrons through the germanium. But before these elements can be introduced, it is necessary to start with germanium of exceptional purity, so that the impurities will not interfere with the elements that are deliberately added.

So Bell Telephone Laboratories devised an entirely new method of purification, known as zone refining, which was developed to a high-production stage by Western Electric engineers.

In zone refining a bar of germanium is passed through a heat zone so that a molten section traverses the length of the bar carrying the impurities with it and leaving behind a solidified section of higher purity. By the use of multiple heating zones in tandem, a number of molten sections traverse the bar. Each reduces the impurity content thus producing a bar which contains impurities in the amount of less than five parts per billion.

Because of the importance of the transistor in electronics, the zone refining process – like so many other Western Electric developments – has been made available to companies licensed by Western Electric to manufacture transistors.

This is one more example of creative engineering by Western Electric men. Engineers of all skills – mechanical, electrical, chemical, industrial, metallurgical, and civil – are needed to help us show the way in fundamental manufacturing techniques.

Western Electric

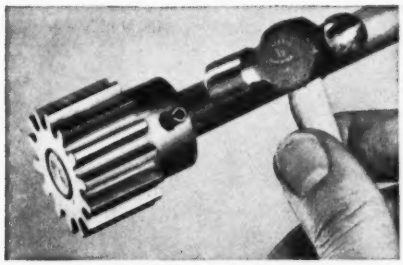
A UNIT OF THE BELL SYSTEM SINCE 1882

Manufacturing plants in Chicago, Ill. • Kearny, N. J. • Baltimore, Md. • Indianapolis, Ind. • Allentown & Laureldale, Pa. • Burlington, Greensboro & Winston-Salem, N. C. • Buffalo, N. Y. • Haverhill & Lawrence, Mass. • Lincoln, Neb. • St. Paul & Duluth, Minn. Distributing Centers in 29 cities and Installation headquarters in 15 cities. Company headquarters, 195 Broadway, New York City.

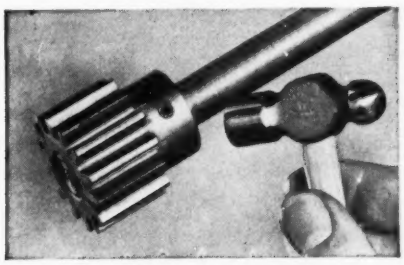
Where will you use this simple fastener?

Rollpin is driven into holes drilled to normal production-line tolerances.

No threading, peening or precision drilling with ROLLPIN



It compresses as driven.



Rollpin fits flush . . . is vibration-proof.

Rollpin is the slotted tubular steel pin with chamfered ends that is cutting production and maintenance costs in every class of industry.

This modern fastener drives easily into standard holes, compressing as driven. Its spring action locks it in place—regardless of impact loading, stress reversals or severe vibration. Rollpin is readily removable and can be re-used in the same hole.

* * *

If you use locating dowels, hinge pins, rivets, set screws—or straight, knurled, tapered or cotter type pins—Rollpin can cut your costs. Mail our coupon for design information.

Elastic Stop Nut Corporation of America
Dept. R16-CM, 2330 Vauxhall Road, Union, N. J.

Please send me the following free fastening information:

☐ Rollpin bulletin

☐ Elastic Stop Nut bulletin

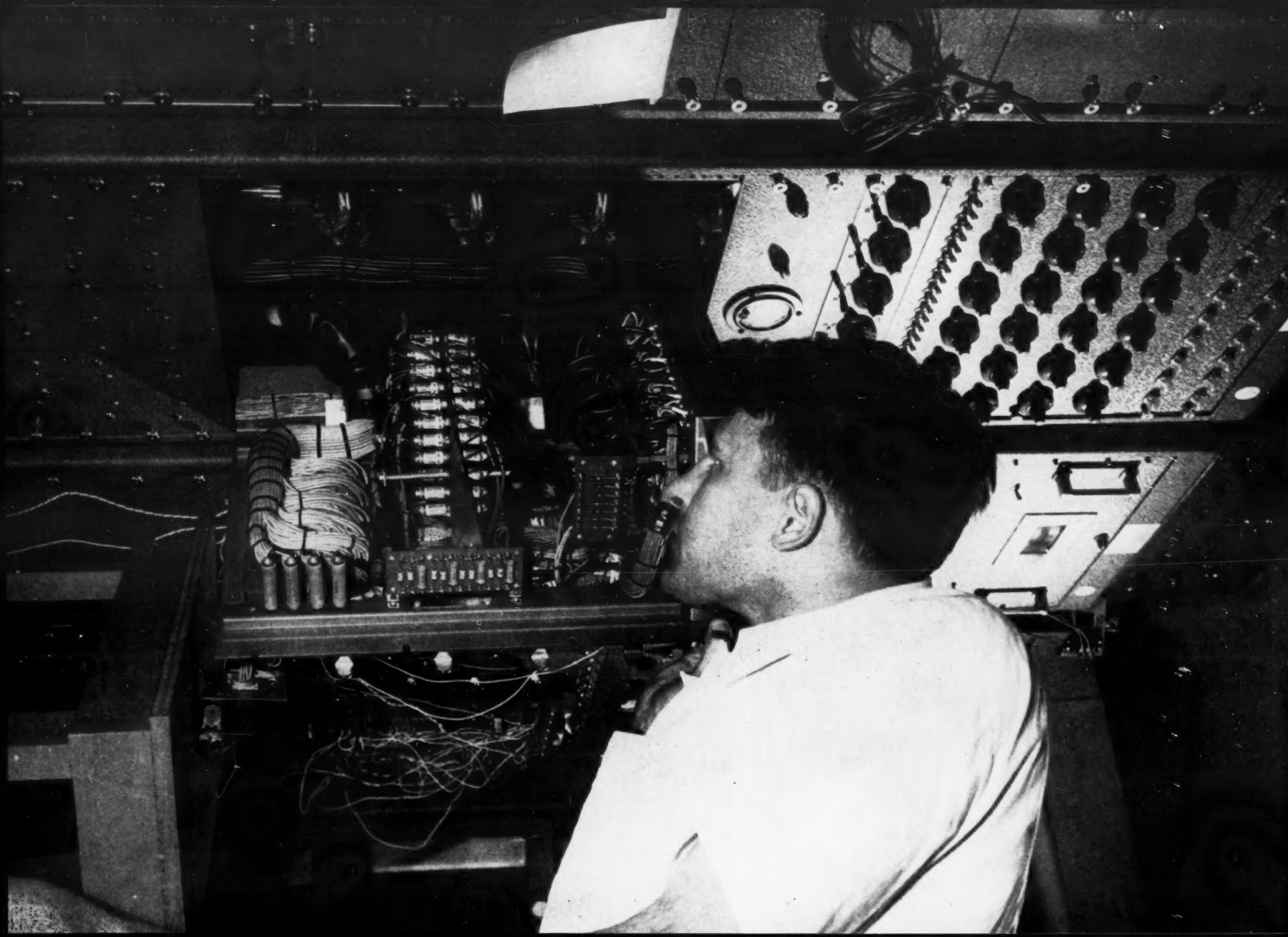
☐ Here is a drawing of our product. What fastener would you suggest?

*Name*_____ *Title*_____

*Firm*_____

*Street*_____

*City*_____ *Zone*_____ *State*_____



ENGINEERS IN CIVIL DEFENSE - I

By HOWARD C. YOUNG, M.E. '19

If an enemy should attack our cities with atomic bombs, emergency engineering problems of a magnitude never before experienced in the United States would be created. Rubble and debris would fill the streets, blocking access to damaged areas, and essential services such as communications, power, gas, water supply and sewage would be disrupted. Engineers would have an extremely important part to play in coping with these problems. Undergraduate engineering students normally do not have time to engage in the civil defense program of their community, but they should know something about the engineer's role in civil defense in order to be able to participate effectively in event of a surprise attack on this country.

The major functional areas in which engineers have a primary responsibility in civil defense include:

(a) Traffic engineering.
(b) Water facilities.
(c) Sewage and other waste disposal systems.
(d) Electric power and gas.
(e) Debris clearance.
(f) Shoring and demolition.
(g) Emergency housing.
(h) Hospital and public building emergency restoration.
(i) Shelter design, construction, designation and maintenance.
(j) Establishment of building codes and standards.
(k) Design of protective construction.
(l) Dispersion of industrial, commercial, and housing facilities.
(m) Port and terminal facility emergency restoration.
(n) Preparation of graves for burial.

I have selected several of the engineer's principal activities to discuss here: (1) Traffic circulation planning; (2) Debris clearance of streets and highways; (3) Utility service restoration; and have included some information on FCDA's engineering equipment national stockpiling program.

Traffic Circulation Planning

A city which has been subjected to an atomic bombing can be helped easily only if a workable traffic control plan has been devised beforehand. Failure of the transportation system would result in failure of vital civil defense activities, thus making the entire civil defense program inoperative.

The number of vehicles using the streets during normal periods of congestion is small in comparison with the number that would probably attempt to crowd onto them following an atomic explosion unless preventive measures have been taken. The limited street system that would be available could not possibly satisfy demands of both the general public and emergency civil defense traffic. Therefore, the general public traffic will have to yield to emergency traffic for the good of imperiled persons and the entire community. Pre-emergency civil defense measures should include the selection of the most feasible routes leading to the probable damage and the development of plans for circulation, regulation, and control of emergency traffic by both state and local officials following enemy attack.

Planning effective utilization and control of street and highway facilities is a joint endeavor requiring the cooperation of many services of the state and local civil defense organizations. The traffic engineer (acting for the civil defense chief of engineering services), drawing on information readily available to him, prepares the basic traffic circula-

An engineer at Cornell Aeronautical Laboratory, Buffalo, N. Y., inspects the circuits of an electronic analog computer.

ABOUT THE AUTHOR

With this issue Howard Young makes his second appearance in the Cornell Engineer. In our February, 1952, issue we published his article, "Cranes Through the Ages," two copies of which are now on file in the Smithsonian Institute.

After graduation from Cornell Mr. Young worked in the lamp and lighting field for General Electric, General Electric Supply Corporation, the Miller Company of Meriden, Connecticut, and Associated Gas and Electric Company, Elmira, New York.

He was Lighting Director at Elmira for 4 years, supervising the work of people engaged in developing the Company's residential, commercial, and industrial lighting loads in 3 states. During World War II he was Educational Director for C. G. Con., Ltd. Elkhart, Indiana, and trained about 2000 new employees in war production operations for manufacturing precision aviation equipment for the United States Army and Navy. He also taught 12 Purdue ESMWT courses there for the firm's technical personnel. These courses included mathematics, engineering physics, engineering drawing, production methods, time and motion study, and quality control.

Since 1946 Mr. Young has been in Washington, D.C., employed first as an engineer with the Department of the Navy, and since 1951 as Chief of the Manuals Section, Federal Civil Defense Administration.

He is also associated with the American Society for Safety Engineers, and has turned out publications for them such as, "Safe Work Practices in the Naval Shore Establishment."

tion plan. He consults with the police services relative to control and operation of the plan. He relies upon the transportation service for advice concerning the number, type, and movement of mass transit vehicles. He integrates the plan with emergency communications services operations to assure proper transmission of order and control on the highway system. The entire plan must be coordinated with those of appropriate military authorities to provide for their essential movement requirements in an emergency. The public information officials perform a very important function in the pre-education of the public concerning their conduct during an attack and the restrictions placed upon them in the use of selected emergency routes. Upon the block warden falls the initial responsibility for control of the people under his jurisdiction.

The emergency network of highways for the state should link all cities and communities capable of rendering mobile support, permit rapid movement of large volumes of traffic, require a minimum of policing, and be capable of supporting heavy loads and provide sufficient clearance for oversized vehicles such as those hauling cranes and tractors. Detailed selection of these routes is the duty of the state traffic engineer acting for the state chief of engineering services. The state should confer with civil defense officials in neighboring states to assure an inter-connected regional network of emergency routes for support between states.

The traffic circulation plan in target cities should be flexible so that alternate routes may be used if necessary immediately after an attack. The local traffic engineer should coordinate his selection of streets with state officials so that his emergency network connects with selected emergency routes leading into the city. Some of the factors involved in the selection of the emergency system in urban areas are the peculiar requirements and clearances necessary for large vehicles such as heavy engineering equipment and fire-fighting apparatus, the location of portable areas in which the various classes of emergency vehicles will operate, maximum traffic capacities, streets

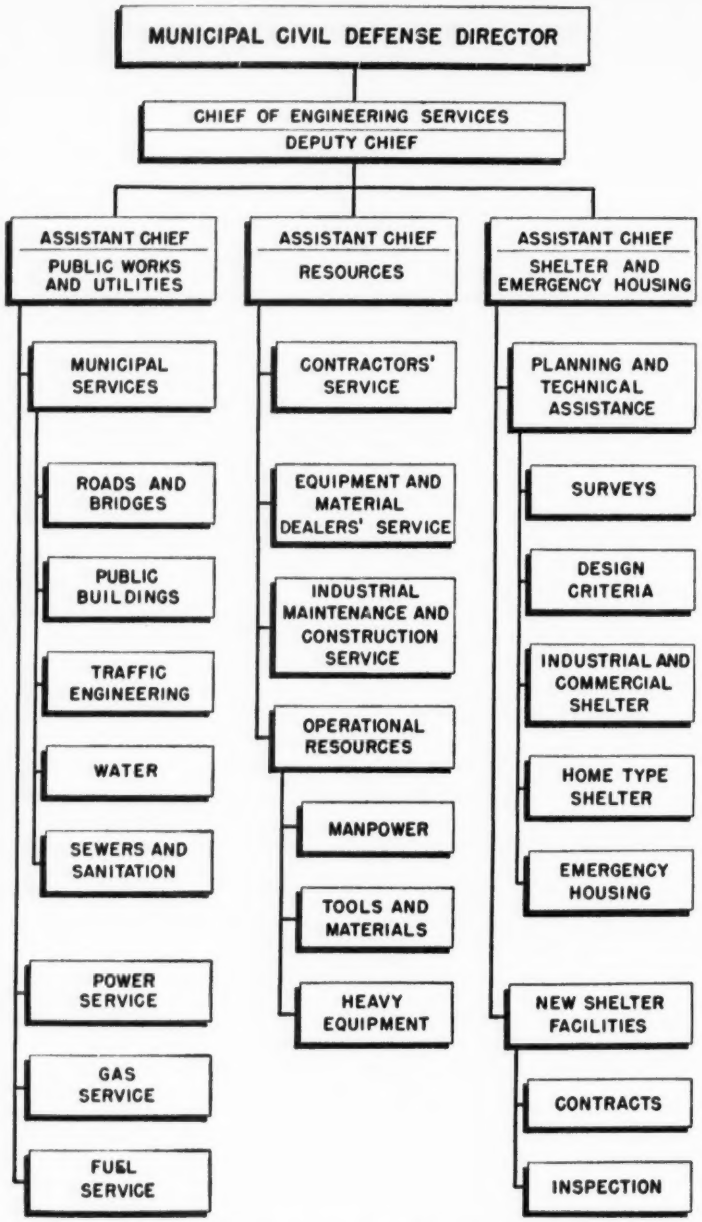


Fig. 1. Organization plan of a suggested muncipal engineering services operational staff.

adaptable to prohibition of parking on one-way operation, and streets that can be assumed to have a small probability of blockage by debris. Although most of the emergency traffic may operate in a radial pattern, the emergency street network will not be complete without a system of inter-connecting laterals to form a series of circumferential routes within the municipality and adjacent metropolitan areas.

Once a traffic circulation plan has been adopted, the engineering services, in cooperation with transportation and police services, will establish priorities for clearance of streets and highways, taking into account the urgent need of the street for transportation and the nature of obstructions and time required for their removal. Necessary adjustments of these priorities can be made after the attack. Principal problems confronting the police assigned to operate the emergency system will be disposing of traffic using the emergency system at the time of the attack, improvising tem-

TABLE A.—DAMAGE ZONES FOR VARIOUS SIZES OF ATOMIC WEAPONS

Bomb size	TNT equivalent (tons)	Zone A—virtually completed structural destruction		Zone B—severe damage		Zone C—moderate damage		Zone D—Partial damage	
		Radii miles	Area square miles	Radii miles	Area square miles	Radii miles	Area square miles	Radii miles	Area square miles
1(X)	20,000	0.0-0.5	0.8	0.5-1.0	2.3	1.0-1.5	3.9	1.5-2.0	5.5
2½(X)	50,000	0.0-0.7	1.5	0.7-1.4	4.2	1.4-2.0	7.1	2.0-2.7	10.1
5(X)	100,000	0.0-0.9	2.3	0.9-1.7	6.9	1.7-2.6	11.5	2.6-3.4	16.1
10(X)	200,000	0.0-1.1	3.5	1.1-2.1	10.6	2.1-3.2	17.8	3.2-4.3	25.0
25(X)	500,000	0.0-1.5	6.7	1.5-2.9	20.4	2.9-4.4	34.0	4.4-5.9	47.7
50(X)	1,000,000	0.0-1.8	11.0	1.8-3.7	32.0	3.7-5.5	53.0	5.5-7.4	74.0

porary emergency routes in the damaged areas in the event preselected routes are impassable, maintaining right-of-way for emergency vehicles, and controlling the flow of traffic into and out of the city in cooperation with state police.

Debris Clearance of Street

In any locality the kind and quantity of obstacles, debris, and rubble resulting from an atomic air burst would depend upon physical development of the area, distance from ground zero (the point on the ground directly below the burst), height of the burst, and power of the weapon. Physical development includes such things as building construction, building height, and building density. For purposes of description and analysis, the area of damage from an A-bomb is divided into the following four zones:

(a) Zone of A-damage — virtually complete structural destruction.

(b) Zone of B-damage—severe damage.

(c) Zone of C-damage—moderate damage.

(d) Zone of D-damage—partial damage.

There is no clear-cut line of demarcation between these zones. The closer to ground zero the greater the damage. Nevertheless, the classification is very useful in appraising probable damage and in developing a plan of emergency clearance and restoration. (See Figure 2.)

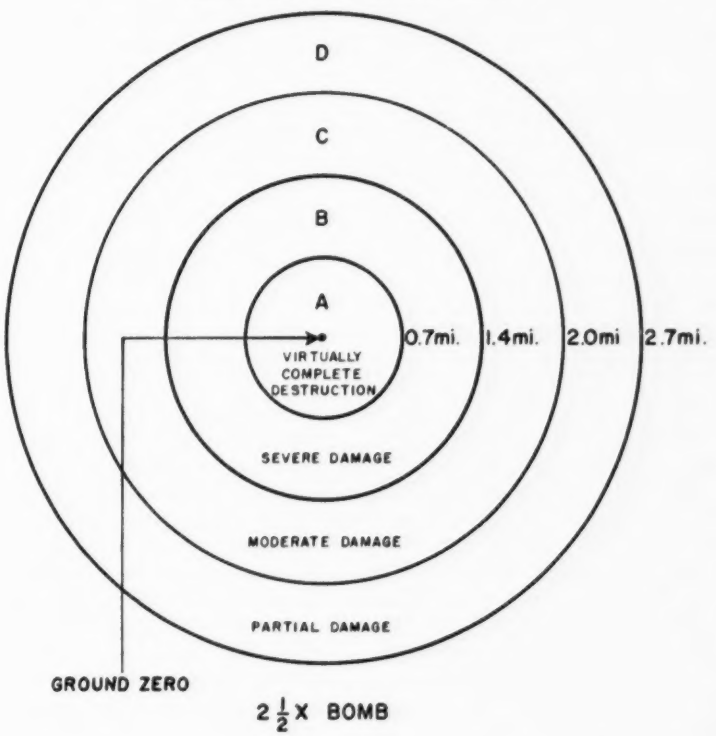
An atomic bomb of the same power as those dropped in Japan is called a 1(X) bomb and releases energy equivalent to 20,000 tons of TNT. A bomb two and one-half times as powerful is called a 2½(X) bomb, etc. As can be seen from table A, the more powerful the bomb, the greater is the area of damage. However, an increase in the power of the bomb does not yield a proportional increase in the area of damage. For example, the 25(X) bomb mentioned by President Eisenhower in his address last fall (Dec. 8, 1953), although 25 times as powerful as those dropped in Japan, has a radius of destruction only 3 times as large and an area of destruction 9 times as large as the 1(X) bomb.

The damage inflicted upon the street system of a target city would consist largely of blocking the streets and highways with debris. Except for bridges, structural damage to highway facilities from an A-bomb air burst would be confined to ground displacement caused by the shock wave. This displacement might be great enough to cause cracks in the pavement, but it is not expected that these would be of serious consequence. Fire might cause considerable damage to bituminous surfaces. Extensive damage to the highway drainage system can be anticipated and the seriousness of this damage will be aggravated by the probability that sewer and water services will also be broken and that firefighting activities will add to the surface water problem. Broken gas and electrical lines will increase the difficulty of restoring highway facilities. But, in general, it is believed that most of our streets and highways would be usable to a minimum standard of sufficiency once the debris and rubble had been removed.

Analysis of Clearance Task

The rubble and debris clearance task must be analyzed to develop manpower and equipment requirements. The operation would be calculated first, on the amount of de-

Fig 2. Zones showing the degree of damage from an A-bomb 2½ times more powerful than the type exploded at Hiroshima.



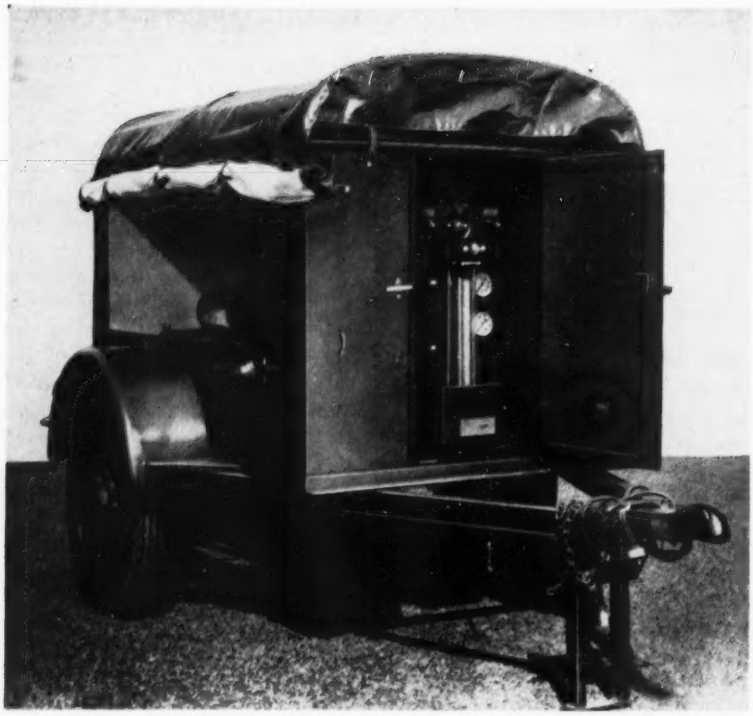


Fig. 3. This mobile chlorinator, and other emergency equipment which FCDA is stockpiling, will be discussed in the concluding section of this article, next month.

bris to be removed; second, the type and capacity of equipment needed, and third, the average time involved by the several basic machines (e.g. shovel, crane, bulldozer, clamshell bucket) in moving the debris. The combined calculations would result in the establishment of basic clearance teams, and the approximate mileage that could be covered by their combined effort. The number of teams needed by any target city will vary with its size, but broadly speaking, there would be from 3 to 6 teams for every street designated as a civil defense route. A city of 1,000,000 population would probably require 6 teams per street. These groups would be operationally self-sufficient in equipment, manpower, and supplies. The operational plan assigns groups specific tasks or routes to be cleared, and designates an assembly point or operating base for each group. Total number of personnel required for clearing streets and highways to a minimum usable standard in a 24-hour shift (three 8-hour shifts), allowing one-third to offset casualties, is calculated to be about 4500 men.

It would be desirable to divide the clearance task into three stages. *The first stage* might consist of clearing four 20-foot lanes entering the heart of the city from the four major compass points, and a circumferential route approximately 1½ mile radius from ground zero. This would open about 20 miles of primary streets leading up to and around the periphery of the zone of total damage, thereby providing fire and rescue lanes for mobile equipment. This phase could start approximately one hour after the bomb struck (0+1 hour) and be completed four hours thereafter (0+5 hours).

The second phase might consist of cutting additional radial streets and a new circumferential road at approximately a 2½ mile radius from ground zero. This stage is required for vehicle access to remove injured and for water, sewer, gas, and electricity utility repair vehicles and personnel to enter the area and make essential repairs. In all, about 40 miles of secondary streets would be cleared. It is estimated that this stage would start at approximately 0+5 hours, and that the completion time would be approximately 0+13 hours.

The third stage, that of adding about 72 more miles of connecting roads and circumferentials, would start as soon as the first two stages were completed. It is estimated that this action would get started approximately 13 hours after the bomb struck (0 + 13 hours) and probably would not be completed until about eleven hours later (0 + 24 hours). On this basis of operation, the entire emergency debris clearance task should be accomplished about 24 hours after the bomb burst.

Utility Service Restoration

Our ability to wage war rests largely on saving lives and property and on keeping our essential facilities and vital industries in operation. These facilities must have a continuous supply of adequate electric power, gas, and water services. The importance of maintaining these services, particularly in our concentrated industrial areas, is so great that there must be complete coordination of all the utility company staffs in a municipality with the state and local civil defense organizations in the development and operation of the civil defense program.

Generally speaking, operational responsibility for restoration of the utility services in emergencies will be vested in utility managements. However, the responsibility for determining the priority in which emergency service is to be provided rests with the state and/or local civil defense director.

The power, gas, water, sewer, and other utility companies are organized to provide continuous service to the public 24 hours a day and 365 days a year; however, an emergency brought about by an enemy air attack would call for a great expansion of their existing service and repair organizations.

In preparing to meet wartime conditions, utilities survey their organization and resources and develop comprehensive plans that will make them better equipped to contend with such abnormal conditions. Each utility company appoints an official as civil defense coordinator who will be responsible to the local civil defense director through his engineering services

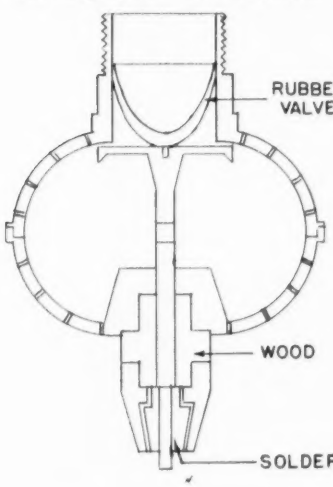
(*Continued on page* 44)

The Automatic Sprinkler

By ROBERT Z. FOWLER, EE '54

The automatic sprinkler head is a relatively simple device which was not used extensively until more than a century after its conception because of the large number of engineering problems associated with making it reliable enough to sell. A sprinkler system may not be called upon to operate until many years after its installation, and it therefore must be just as operable at any such time as when it is first installed. This specification led directly to many of the problems involved in the development of the sprinkler head. The time spent and the ingenuity displayed in the invention of automatic sprinklers has been prodigious. In the last century more than 450 patents have been taken out in this country on various types and modifications of sprinklers. Many of the early sprinkler heads were very clever and often amusing, but the vast majority were worthless. Today fewer than ten basic types are in use. The purpose of this article is to discuss the development of sprinklers from the earliest crude attempts of which we have any records to the present-day versions that have been improved to the extent that they are virtually fool-proof over extended periods of time with little or no servicing.

Fig. 1. Early sprinkler head in cross section, showing features of construction and design that are still employed.



HARRISON SPRINKLER
(SECTION)

The first form of sprinkler actually used was the perforated pipe. The perforations were placed at intervals of from four to twelve inches along the pipes which ran close to the ceiling. Water was supplied from elevated reservoirs or by pumps.

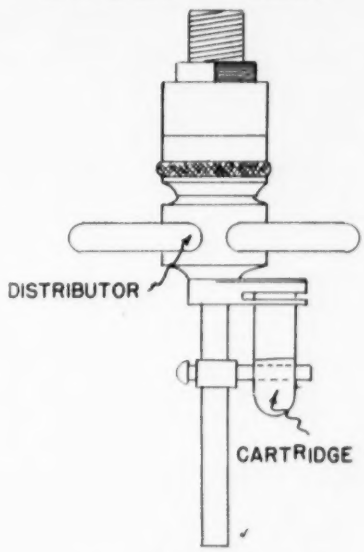
Automatic Fire Extinguishers

The first automatic fire extinguisher of which there is any record was patented in England early in the eighteenth century. It consisted of a cask of fire-extinguishing liquid containing a chamber filled with gunpowder. The combination was connected to a system of fuses which, when ignited, exploded the gunpowder and scattered the extinguishing liquid. Another early automatic extinguisher employed a system of cords, any one of which, when burned through, would release a valve and cause water to spray over the room. In addition to the unsightliness of this device, the cords stretched after a period of time and caused a leaky valve. An improvement of this device, consisting of metallic cords held in place by low-melting-point metal links, was the first sprinkler patented in this country.

The introduction of solder as the tripping mechanism was perhaps the most important step in the development of the sprinkler head. A very simple system used perforated pipes with the holes plugged with solder. Several variations of this idea were tried but were unreliable because the perforations often became plugged by dirt and rust from the inside. This defect led to the use of valves held in place by solder. The early valve sprinklers were also generally unsatisfactory because little effort was made to insulate the solder from the rest of the mechanism. It was necessary for the entire sprinkler, as well as the water, to heat up to the melting point of the solder before the solder would fuse. This same disadvantage existed in the perforated pipe systems mentioned earlier in the paragraph.

The first sprinkler head which employed a number of features still in use today is shown in Figure 1. The upper part of the head was cylindrical and threaded to be screwed into a pipe. Inside the upper part was a cup-shaped rubber valve that tended to become more tightly sealed as the water pressure increased, a feature that was absent in earlier models. The rubber valve was held in place by a metal shaft that extended through a wooden block into a cup of solder. The purpose of the wooden block was to insulate the solder from the main casting and thereby increase the sensitivity of the device. Another desirable feature was the fact that

Fig. 2. Improved type of sprinkler head employed a rotating ejection system similar to modern lawn sprinklers.



KANE-CARTRIDGE
SPRINKLER

Fig. 3. Typical valve used in sprinklers. This photograph is slightly larger than actual size.

the rubber valve had to slide a considerable distance, giving the solder sufficient time to completely liquefy. Otherwise, the water would have chilled the solder before the valve fully opened. The major difficulties with this head were the possibility of the holes becoming clogged and of deterioration of the soft rubber valve.

Novel Systems

Although by the middle of the nineteenth century the use of fusable solder as the detecting agent was firmly established, other methods were later tried and discarded. In addition to the burning cord and exploding gunpowder, these other methods included the expansion and melting of wax and the expansion of perforated steam pipes. Perhaps the most interesting was a device invented in this country and shown in Figure 2. The valve was held closed by a rod extending down through the bottom of the head. This rod was clamped to the slug of a cartridge by means of a hole bored through the slug. The cartridge casing was fastened to the main casting. Excessive heat exploded the cartridge, opening the valve, and making it extremely dangerous to those on the floor beneath.

The distributing mechanism of the sprinkler of Figure 2 illustrates an improvement which eliminated the headaches of the perforated distributors of earlier sprinklers. The sprinkler in Figure 2 ejected the water by means of the curved arms that rotated as the water passed through them. Perforated heads tended to clog up with pipe scale, dirt, and paint; hence, they were not very reliable. A head with a distributing device similar to that of Figure 2 was the first sprinkler used extensively in this country. It consisted of a rotating slotted turbine on the end of a pipe. The turbine was enclosed by a metal cap that was soldered to a cylindrical ring around the pipe. When the solder melted, the cap was thrown off by the water pressure.

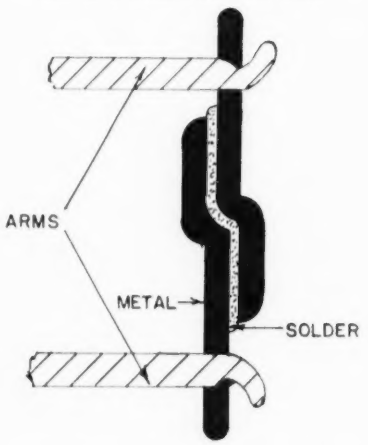
A big disadvantage of solder is that it cannot withstand much mechanical stress. When in tension or shear, solder is subject to cold flow, and this characteristic becomes worse as the temperature increases. This property of solder caused much grief to sprinkler manufacturers when their products developed leaks some time after their installation. A remedy was found in the use of levers and linkages to reduce the stress on the solder to a valve below which it would not cold flow. This system is still used in our modern sprinklers. It is important, however, to maintain sufficient stress to enable the melting of the solder to release the valve.

Introduction of Deflectors

A further improvement in sprinkler heads was the introduction of deflectors to replace the perforated distributors and the turbine distributors. Neither of these latter types gave the proper distribution of water. The turbine distributor had the additional disadvantage of containing moving parts which often became inoperable after a period of time if not properly serviced. All modern sprinklers use sprinkler heads that play a stream of water on a slotted deflector. The deflector has no moving parts and

(*Continued on page* 44)

Fig. 4. Schmatic drawing of the link section in a modern sprinkler head.



Retiring Board Members

Each year at this time the CORNELL ENGINEER elects a new publication board to replace those whose service to the magazine will soon be terminated by graduation. It is only fitting, therefore, that due recognition be accorded the men and women who have formulated and guided the policies of the ENGINEER throughout the past year. The 1954-55 board congratulates them for a job well done and wishes them success in the future.

Janice Button, E.P. '54

As editor-in-chief of the ENGINEER, Janice Button has once again shown her ability for leadership and skill for accomplishing what must be done. With her wide experience in many activities, her extensive knowledge in the technical field, and her diplomacy and tact in handling the problems of an undergraduate organization, she has guided the ENGINEER through another very successful year. Jan, who will receive her degree in the Department of Engineering Physics this June, has been with the staff for over four years, moving up to her recently held position via the associate editor's post.

Jan came to Cornell from Dayton, Ohio with a childhood love for math and physics, a high school fame as a piano soloist, having appeared with the Dayton Philharmonic Orchestra, and as an honor student with an excellent citizenship record. Since then, she has made an outstanding name for herself both scholastically and through her participation in a variety of activities. As a freshman in E.P., Jan stood first in her class. Even though she since has joined such groups as: One World Club, A Cappella Choir (as piano accompanist and soloist), Kappa Kappa Gamma sorority, the campus radio organization of CURW, Rocket Society, Engineering Physics school society, Women's Athletics Association, and a junior activities honorary, Jan now stands fifth in a class of 23 EPs. Besides being active in the Women's Student Government Association, rising to president for 1952-53, she has been an ex-officio member of Student Council, a representative to two student-faculty committees, a dormitory president, and a class council member. In her junior year Jan was elected to Tau Beta Pi as an honorary member. In addition she belongs to two academic societies: Mortar Board and Pi Delta Epsilon (journalism). In the One World Club Jan has been a participant in and a counselor for a number of international student conferences, and this year is a policy board member. This wide range of activities shows, more than anything else, Jan's interest in dealing with people. Her latest venture involves the organization Via, a women's living unit which will enable girls to live on a co-op basis and foster educational and intellectual ideals.

During summers Jan has worked in the Oak Ridge National Laboratories and the Cornell Aeronautical Laboratory, but this summer she hopes to get a Fulbright Scholarship to study physics in Germany. After this Jan plans to come back to Cornell and work towards her doctorate, doing research in physics. Eventually she wishes to combine marriage with her career, but, according to Jan, she will cross her bridges when she comes to them.

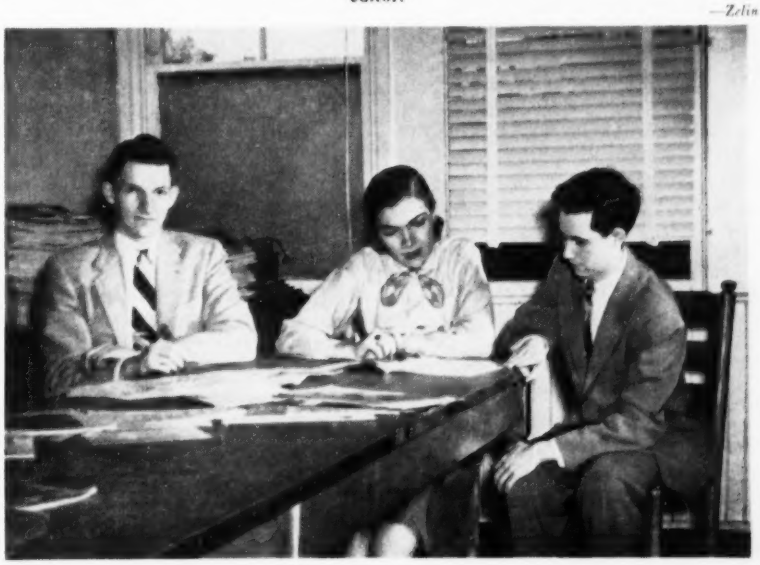
M. Douglas McIlroy, E.P. '54

Doug McIlroy, now concluding his fifth year in the School of Engineering Physics, has a career on the CORNELL ENGINEER that is truly a success story. Doug started working on the magazine at the end of his junior year. After being elected to the Editorial Board, he rose in one year's time to become Managing Editor.

In addition to his duties on the Engineer staff, Doug has participated in a variety of other campus activities. He is a member of Acacia Fraternity, where he held the of-

Retiring members of the editorial and illustrations boards. From left to right, Douglas McIlroy—managing editor, Janice Button—editor-in-chief, Alan Cohen—illustrations editor.

—Zelin



fices of rushing chairman and alumni secretary. Over the past few years, Doug has ably filled the chairmanship of several Red Cross blood drives on the campus. He has worked as an assistant scout-master for a local boy scout troop for three years. Doug was the chairman of the Engineering Physics Engineer's Day exhibit last year.

A member of the engineering honorary Tau Beta Pi, the Pi Delta Epsilon Journalism Society, and the campus-wide scholastic organization Phi Kappa Phi, Doug has been active in university honorary groups. He holds a Cornell University Undergraduate Scholarship, a State Regents Scholarship, and has consisitently made the Dean's List.

In preparation for his science career, Doug worked for the Owens-Illinois Glass Company at Toledo between his junior and senior years. Last summer, he worked at the Bell Telephone Laboratory in New Jersey. In the capacity of a junior engineer, Doug was concerned with development of the Terrier guided-missle project as a part of the Military Electronic Development Program.

Looking to the future, Doug plans on doing graduate study in mathematics at MIT. After meeting military service requirements, he would like to work in industry in applied math, and eventually return to Cornell as a teacher of math, physics, or engineering subjects.

George Edwards, E.E. '55

George Edwards, now in his fourth year as an electrical engineering student, has been active on the CORNELL ENGINEER since he was a freshman. After being elected to the Business Board, he was promoted to Treasurer, and more recently, Business Manager of the magazine.

A variety of activities mark George's campus life outside the classroom. He is a member of Theta Xi Fraternity, where he has served as treasurer. In Eta Kappa Nu, an electrical engineering honorary, George held the position of Corresponding Secretary. He also participates in the honorary Delta Club, a social organization for electrical engineers, and is a member of the Electrical Engineering Student Faculty Committee. Utilizing his interest in electronics, George worked on the lighting committee of Octagon and served two years as an engineer for radio station WVBR.

—Zelin

Retiring members of the business board: Robert Arlook—circulation manager (left) and George Edwards—business manager. Missing: Robert Posner—office manager.

In spite of his emphasis on engineering, George's participation in other campus groups indicates his versatility. He was an active member of the Freshman Orientation Committee. He served on the Junior Blazer Committee, and on the Willard Straight Committee as well.

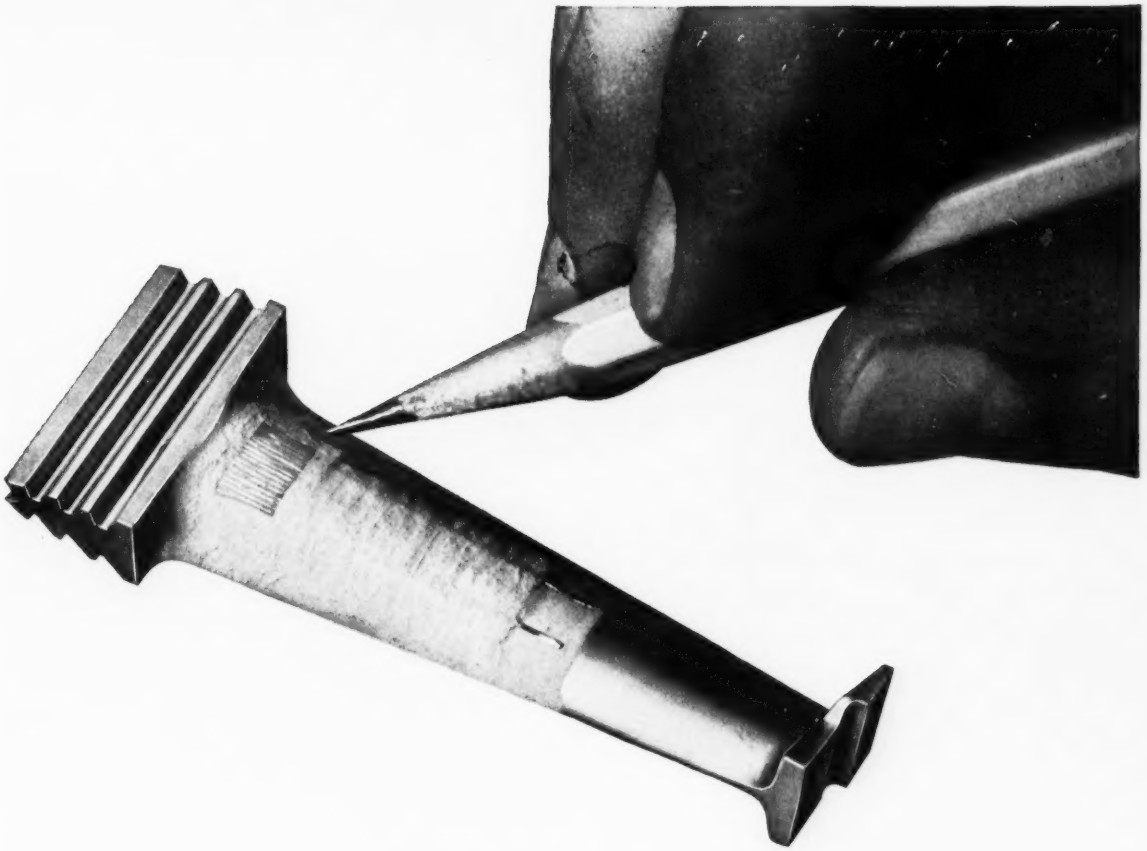
George, whose home is in Beaver, Pennsylvania, holds a John McMullen Scholarship in engineering. His scholastic ability is reflected in his making the Dean's list. As a preview to his engineering career, George has worked for the past three summers for the Westinghouse Electric Corporation. His future plans include a necessary two years of service in the Army Signal Corps. After military service, George plans on working for a large manufacturing company in electrical engineering design and development.

Alan F. Cohen, C.E. '55

Al Cohen's photography has come a long way since the days long ago when a twelve-year-old youngster developed film from his Box Brownie camera in glass pie plates. In his four years here at Cornell, Al has served on the photography boards of the "Cornellian," the "Cornell Daily Sun," and the CORNELL ENGINEER. Al has served two years on the ENGINEER, his last as the illustrations editor. Instead of a Brownie, his array of equipment now includes a Rollieflex, a Speed Graphic, a Canon, and a Kardon, and instead of the blackened film of the beginner he has produced many of the interesting and artful picture briefs in the ENGINEER. But photography is not Al's only hobby; in addition to his magazine work, Al is on the varsity rifle team, the Army ROTC rifle team, and the Rifle Club. Al's other activities include Pi Tau Sigma, a Signal Corps honorary, and Pi Delta Epsilon, a journalism honorary.

Scholastically, Al stands in the upper quarter of his class. Besides civil engineering, physics rates high in Al's interest and during the last few years he has elected six courses in the physics department. Al's summers have been filled mainly with ROTC summer camp, surveying camp, work, and travel; last summer he took a short trip

(Continued on page 30)



important wire on a hot subject . . .

Even at temperatures of 1500° — speeds of 12,000 rpm — this tiny wire grid reports to our engineers on the strains in jet turbine blades. It gives them accurate measurements for calculating stresses caused by resonance and flutter.

This basic information, in turn, permits the design of blades that combine the optimum aerodynamic characteristics with structural integrity.

Strain gages are not new. But our engineers had to advance the art considerably to get readings at these high speeds and temperatures. It required the development of improved cements, instrumentation, slip rings . . . new application techniques and calibration curves.

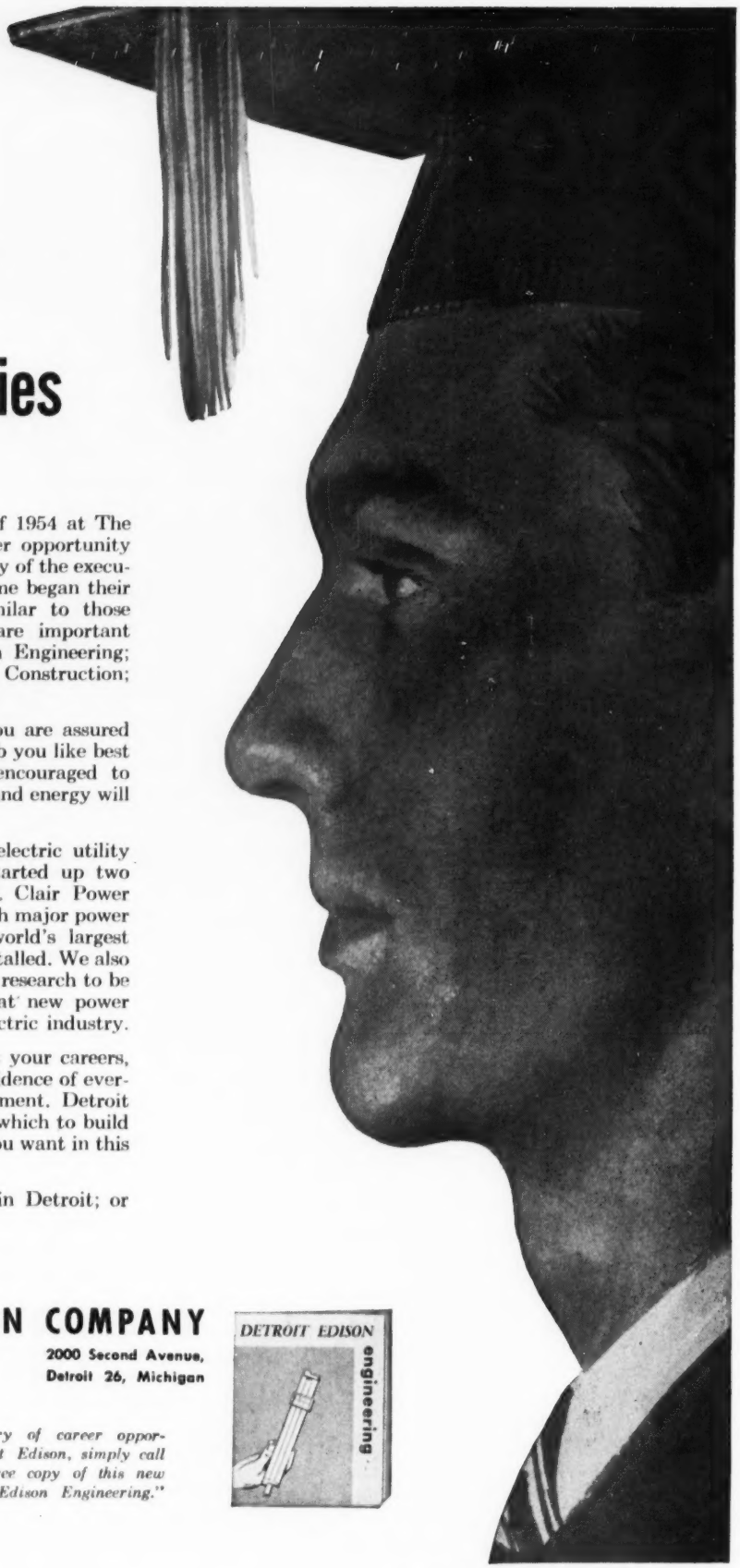
Nothing can be left to chance in the design of aircraft engines for supersonic flight. Thus we use — and frequently improve on — every advanced technique and engineering tool. This straight-forward approach to engineering problems is one of the reasons many outstanding engineering graduates decide on a career at Pratt & Whitney Aircraft.

PRATT & WHITNEY AIRCRAFT

Division of United Aircraft Corporation

East Hartford 8, Connecticut

Career Opportunities



There's a future for you seniors of 1954 at The Detroit Edison Company—a career opportunity best described by the fact that many of the executives in the organization at this time began their climb to success in positions similar to those offered graduates today. There are important jobs to be done in Power System Engineering; Engineering Planning, Design and Construction; Research.

When you join Detroit Edison, you are assured every opportunity to fit into the job you like best —and, once there, you will be encouraged to advance as rapidly as your ability and energy will carry you.

Detroit Edison is a fast-growing electric utility company. In the past year we started up two turbine generators at our new St. Clair Power Plant and broke ground for our sixth major power plant, River Rouge, where the world's largest steam turbine generators will be installed. We also moved forward with atomic energy research to be ready for the time when this great new power resource can be utilized by the electric industry.

To you young men thinking about your careers, expansion like this is heartening evidence of ever-growing opportunities for advancement. Detroit Edison offers a firm foundation on which to build a career. You may find just what you want in this thriving electric company.

Drop in and see us when you're in Detroit; or write . . .

THE DETROIT EDISON COMPANY

2000 Second Avenue, Detroit 26, Michigan

For the full story of career opportunities at Detroit Edison, simply call or write for a free copy of this new booklet, "Detroit Edison Engineering."

Helping the "stars" to shine

A tiny off-stage "sun" brings you brighter and better movies

As YOU SEE the Hollywood "stars" on the screen of the darkened theater—perhaps in 3-D—you can thank a man-made miracle of light—the carbon arc.

This brilliant light comes from tiny carbons not much larger than pencils. Yet their light is brighter than the sun itself—enlarging the tiny pictures on the film as much as 300,000 times!

THEY GIVE YOU THE RAINBOW—Besides the brilliance that brings you clear, sharp moving pictures, these carbons have a light quality almost exactly like that of the sun. This makes possible the production and showing of pictures with all colors of the rainbow.

LIGHT YOU DON'T SEE—The rays from these carbons go beyond the movies into places most of us never see. They reveal quickly how long a new paint will last, and whether colors will fade from new fabrics. They also tell scientists the exact chemical composition of many materials.

BETTER AND BETTER—Making and constantly improving hundreds of carbon and graphite products for industry and science is one of the many ways in which the people of Union Carbide help serve all of us.

STUDENTS AND STUDENT ADVISERS: *Learn more about career opportunities with Union Carbide in* ALLOYS, CARBONS, CHEMICALS, GASES *and* PLASTICS. *Write for booklet B-2.*

UNION CARBIDE
AND CARBON CORPORATION

30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

In Canada: UNION CARBIDE CANADA LIMITED

UCC's Trade-marked Products include

NATIONAL Carbons — ELECTROMET Alloys and Metals — HAYNES STELLITE Alloys — PRESTONE Anti-Freeze — LINDE Oxygen
EVEREADY Flashlights and Batteries — PYROFAX Gas — DYNEL Textile Fibers — UNION Carbide — ACHESON Electrodes
BAKELITE, VINYLITE, and KRENE Plastics — PREST-O-LITE Acetylene — SYNTHETIC ORGANIC CHEMICALS

Brig. General David Sarnoff, Chairman of the Board, Radio Corporation of America

Sees No. 1 wish come true!

Television Tape Recording by RCA Opens New Era of Electronic Photography

In 1956, RCA's General Sarnoff will celebrate his 50th year in the field of radio. Looking ahead to that occasion, three years ago, he asked his family of scientists and researchers for three gifts to mark that anniversary: (1) A television tape recorder, (2) An electronic air conditioner, (3) A true amplifier of light.

Gift No. 1—the video tape recorder—has already been successfully demonstrated, two years ahead of time! Both color and black-and-white TV pictures were instantly recorded without any photographic development or processing.

You can imagine the future importance of this development to television broadcasting, to motion pictures, education, industry and national defense. And you can see its entertainment value to you, in your own home. There the tape equipment could be used for home movies, and—by connecting it to your television set—you could make personal recordings of your favorite TV programs.

Expressing his gratitude for this "gift," Gen. Sarnoff said it was only a matter of time, perhaps two years, before the finishing touches would bring this recording system to commercial reality. He described it as the first major step into an era of "electronic photography."

Such achievements as this, stemming from continuous pioneering in research and engineering, make "RCA" an emblem of quality, dependability and progress.

INTRIGUING OPPORTUNITIES FOR GRADUATING ENGINEERS

You're sure to find the exact type of challenge *you* want in Engineering Development, Design, or Manufacturing at RCA. Men with Bachelor's, Master's or Doctor's degrees in EE, ME, IE or Physics are needed. *You'll find your optimum career work* among the hundreds of products RCA produces for the home, science, industry and Government.

If you have the necessary education and experience, you will be considered for a direct engineering assignment. Otherwise, you'll participate in our Specialized Training Program, in which you can explore RCA's many interesting engineering operations for a full year.

Your rapid professional advancement is enhanced at RCA by the free flow of engineering information.

Write today to: College Relations, RCA Victor, Camden, New Jersey. Or, see your Placement Director.

RADIO CORPORATION OF AMERICA

World leader in radio — first in television

Faculty Profile

Prof. Julian Smith

Those who saw the soil stabilization exhibits at Lincoln and Olin Halls last Engineer's Day saw some results of the research and engineering work of Professor Julian Smith of the Chemical Engineering School. The initial project of studying the physical and chemical properties of soils was given to Professor Benjamin K. Hough of the Civil Engineering School by the Army. In 1950, Dr. Hough was given another contract to study the chemical treatment of soils and applications to soil stabilization. Professor Smith became interested in the project and agreed to work with Professor Hough. By the summer of 1952, Professor Smith was directing the soil stabilization studies.

The first major development was the use of synthetic gravel, called briquets, for road building. Smith directed the building of a road in a swampy area using these briquets. Heavy trucks were able to run on the road successfully without trouble from mud.

Professor Smith took a sabbatical leave during the spring term in 1953 to study equipment for making treated soils for the Army. He also worked with Warren L. McCabe, rewriting his fundamental text in the Chemical Engineering Series. Smith has under contract, and has already outlined, another book on chemical engineering equipment.

Professor Smith has one of the most interesting offices in Olin Hall. A large window overlooks the unit operations lab which is under his charge. He has a blackboard, drawing boards, and stacks of books and U. O. reports. In one corner are samples of dirt and parts of Mechano Sets that he is using to experiment on equipment.

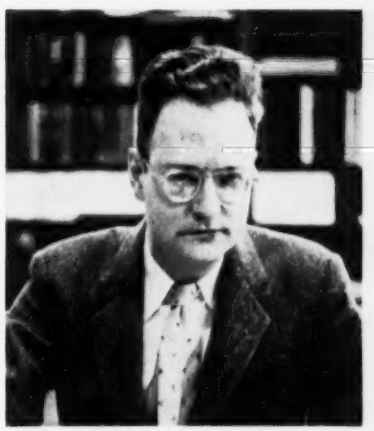
A native of Montreal, Quebec, Professor Smith came to Cornell to study and graduate with his degree of Bachelor of Chemical Engineering in 1941. Chemical Engineering was then taught in the far end of Baker Laboratory with only Dr. F. H. Rhodes, Dr. C. C. Winding, and one other professor on the staff. His class of nineteen was the largest class then to have graduated, the School starting to grow with the War. As he glanced out at the large, three-story unit operations lab in Olin Hall, he smiled as he recalled the "not too impressive" U. O. lab in Baker.

As a student at Cornell, Professor Smith was in Alpha Delta Phi social fraternity. He sang for and accompanied the Glee Club, at one time even considered piano on a concert basis. He was also manager of the ski team and a member of Aljebar. He had four papers on physical chemistry published before he graduated. The honorary fraternities he belongs to include Tau Beta Pi, Phi Kappa Phi, and Sigma Xi.

After graduation, Professor Smith worked as a research chemist for Du Pont in Wilmington, Delaware. Because he was concentrating on fluorine chemicals he worked on the Manhattan project in connection with the gaseous diffusion of uranium hexafluoride. He was then transferred to New Jersey where he worked as a process development engineer at the Chambersworks plant.

In 1946, Dr. Rhodes asked him to come back to Cornell as an Assistant Professor, so he and his bride returned to Ithaca. Last year he became a full professor.

Besides his teaching, Professor Smith does a great deal of summer and consulting work. He was the Technical and Industrial Consultant for the N.Y. State Department of Commerce in 1947 and '48. He has directed the Army work on soils for the past two years. He has also been a consultant for Eastman Kodak, Corning Glass, and other companies.



Prof. Julian Smith

Besides all his work in his professional field, Professor Smith is very active in the civic affairs of Ithaca. He was president of the Junior Chamber of Commerce in 1951-52, having been a member since 1947. He also spent a year's term as a state officer in the J.C.C., serving as district vice-president. He acted as chairman of the cerebral palsey campaign in 1951 and is still working for that cause. He is also on the Appeals Review Board, a local group that decides on the worth of charitable appeals.

In 1950, Julian Smith was awarded the distinguished service award by Ithaca as the Young Man of the Year, a fitting tribute to one of the most promising young men on the vigorous Chemical Engineering Staff.

W V

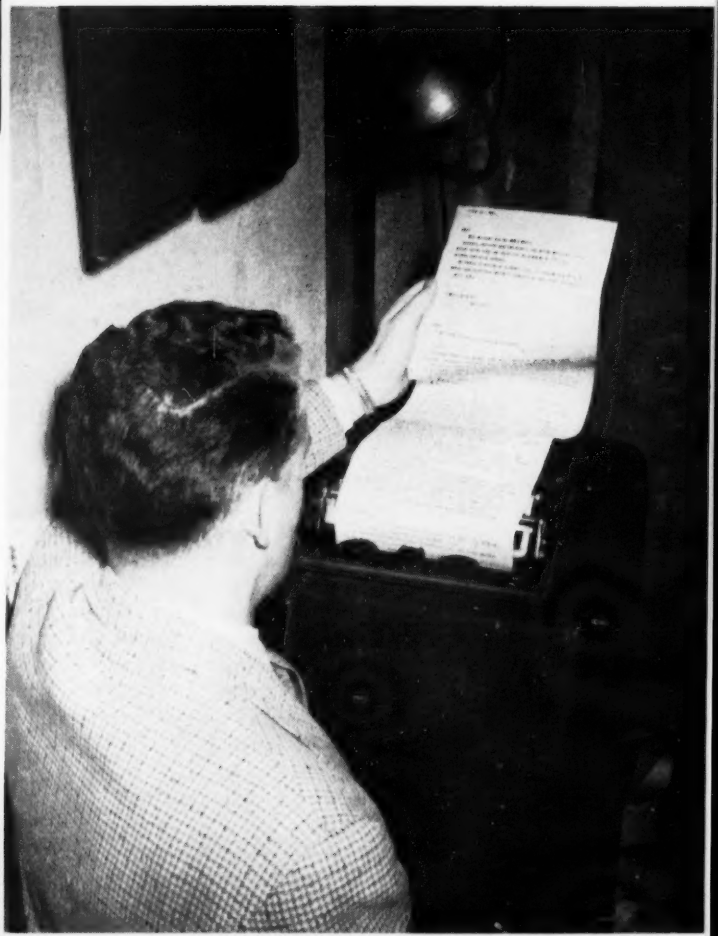
WVBR, the Voice of the Big Red, is a student owned and operated, non-profit, organization—financially independent of the University. The station has a special permit from the Federal Communications Commission, and is a member of the Ivy

Above: Station engineer at the master control board.

Right: Announcer Dave Shetzline "pulling" news, in preparation for a broadcast.

Below right: Neale Van Delft, technical staff member, joins a circuit in a unit that will be installed in the new control room, now under construction.

Below: Ernest Stern interviews Paul Pratt on "Request Show," originating from local eating spot.



B R

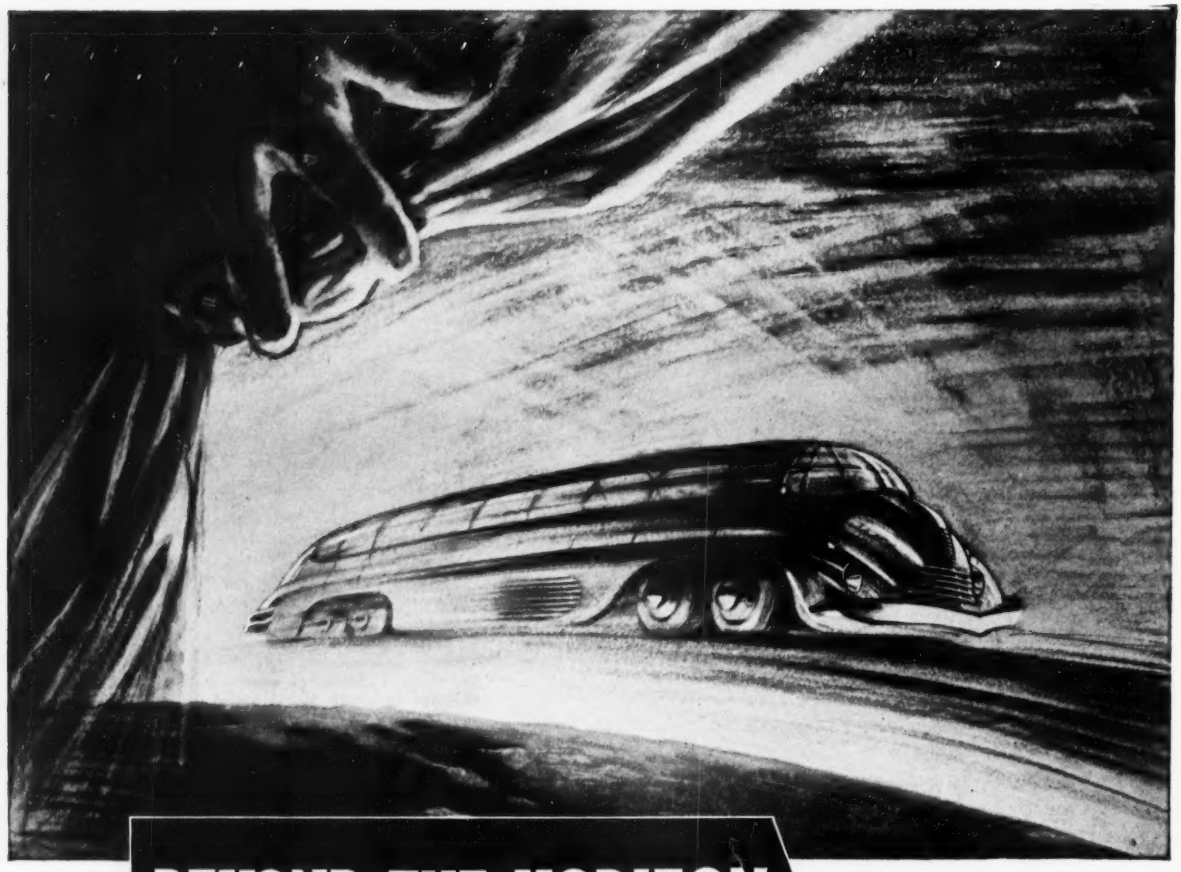
Network. Five transmitters assure good local coverage, and the student staff of engineers, announcers, writers, and directors assures Cornell students of the type of radio listening *they* want to hear. Studios are located in Willard Straight Hall.

Above: Sportscaster Jerry Scher interviews tennis star Jack Kramer (in checkered coat). WVBR serves Cornell with on-the-spot coverage of all major local events.

Left: Station manager Bill Gratz is shown here at the control room rack, putting the station on the air.

Below left: Bill Ellison selects records for his musical program. The station has 3,000 popular records and over 1,000 classical compositions in its musical library.

Below: Station engineers prepare to record on tape while another student, out of camera range, plays the piano.



BEYOND THE HORIZON....

Coming developments in transport—still beyond the horizon—will depend very largely upon the new alloys the metallurgists can supply the engineer. The laws of thermodynamics dictate higher temperatures for greater efficiency in engines and, as the addition of Molybdenum to many alloys allows the use of higher temperatures, it will certainly be used more and more in the engines of the future.

Climax furnishes authoritative engineering data on Molybdenum applications.

Climax Molybdenum Company
500 Fifth Avenue · New York City 36 · N.Y.

C 21

Digital Computer Techniques

Applied to the design, development and application of

Electronic Business Systems

Military Radar Fire Control Systems

Aircraft Control and Navigation Systems

The successful application of Hughes airborne digital computers to high speed aircraft fire control problems has opened up an entire new area for these digital computer techniques.

Similar equipment is now under development in the Advanced Electronics Laboratory to apply such digital computer systems to modern business information handling.

Areas include LOGICAL DESIGN • COMPONENT DEVELOPMENT • PROGRAMMING • MAGNETIC RECORDING • CIRCUIT DESIGN • INPUT & OUTPUT DEVICES • SYSTEMS ANALYSIS • BUSINESS APPLICATIONS ANALYSIS

Hughes *developments in these fields are creating new positions in the Advanced Electronics Laboratory. Exceptional men in the following spheres of endeavor are invited to apply:*

ENGINEERS AND PHYSICISTS

Computer activities embrace systems planning and analysis, design and development, system engineering and component development. Experience in these areas, as well as in application of electronic digital computers, is desirable but not essential. Analytically inclined men with backgrounds in systems work are required for this phase.

COMPUTER APPLICATIONS SPECIALISTS

Experience in the application of electronic digital computers to business problems is desirable, but not essential. Specifically, men are required who can bring ingenuity and a fresh approach to a formulation of fundamental requirements of business data handling and accounting problems.

Hughes

RESEARCH AND DEVELOPMENT LABORATORIES

Scientific and Engineering Staff

Culver City, Los Angeles County, California

CORNELL SOCIETY OF ENGINEERS

107 EAST 48TH STREET 1953-54 NEW YORK 17, N.Y.

THOMAS W. HOPPER, M.E. '28, *President* .....1700 Sansom St., Phila. 3, Pa.
WALTER M. BACON, E.E. '30 .....*Executive Vice-President*
510 East 84th St., New York 28, N. Y.
WALTER L. HARDY, Ch.E. '38 .....*Secretary-Treasurer*
421 East 20th St., New York 10, N. Y.
WILLIAM M. LEONARD, M.E. '24 .....*Recording Secretary*
4 Irving Pl., New York 3, N. Y.

Delaware Valley Branch
FRANK L. O'BRIEN, JR., M.E. '31, *Vice-Pres.* ....1545 N. Delaware Ave. Phila. 25, Pa.

New England Branch
J. RUSSELL CLARKE, JR., M.E. '26, *Vice-Pres.* .....Westford Rd., Concord, Mass.

New Jersey Branch
JOHN WEIKART, Ch.E. '42, *Vice-Pres.* .....714 Woodland Ave., Westfield, N. J.

Chicago Branch
FREDERICK H. BIRD, M.E. '11, *Vice-Pres.* .....1077 Westmoor Rd., Winnetka, Ill.

Detroit Branch
PHILIP J. KENT, M.E. '14, *Vice-Pres.* .....P.O. Box 1118, Detroit 31, Mich.

St. Louis Branch
ARTHUR J. LEUSSLER, M.E. '23, *Vice-Pres.* .....30 Rio Vista Dr., Clayton 5, Mo.

Honorary President: S. C. Hollister, Dean of the College of Engineering

Honorary Vice Presidents:
C. R. Burrows, Director of the School of Electrical Engineering
N. A. Christensen, Director of the School of Civil Engineering
H. J. Loberg, Director of the Sibley School of Mechanical Engineering
F. H. Rhodes, Director of the School of Chemical and Metallurgical Engineering
W. R. Sears, Director of the Graduate School of Aeronautical Engineering
L. P. Smith, Director of the Department of Engineering Physics

Thomas W. Hopper

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish closer relationship between the college and the alumni."

If this country is to continue as the most powerful nation in the world, it must retain leadership in the application of scientific developments to the mass production of quality goods. This requires the employment of an ever increasing number of engineers and a better utilization of the available engineering talent.

Increasing the number of competent engineers implies an increase in the number of engineers graduating from college each year or an enlargement of college enrollments and the capacities of such institutions.

Enrollments to engineering colleges receded after the second world war for two reasons. First, the crop of depression year children, which was small in comparison to that of other years, reached college about that time. Second, a slight business recession gave people the erroneous idea that there were more engineers than jobs. This theme was given publicity by a magazine with the result that many boys who should have entered engineering took some other vocation. Public opinion was later changed by the vigorous action of certain businessmen and educators of whom our own Dean Hollister was the outstanding leader. Their efforts together with the greatly expanded program of defense, gradually turned the downward trend of engineering enrollments to an upward swing.

The problem in the future will rapidly shift from inadequate enrollments to inadequate facilities. The great tidal wave of children born during the early years of World War II is now flooding our grammar schools, overloading the existing facilities and causing many hundreds of new schools to be built. These large classes will reach college age in 1961 or 1962 and the colleges will have to decide whether to expand or turn the aspiring applicants away. Taxpayers who have faced the problem of financing and operating new schools in their community, will appreciate what is involved in providing new universities or expanded college facilities based on private or public funds. The problem of providing an adequate engineering education to the ever increasing number of candidates must be solved. Its solution will be one of the great accomplishments of our times.

The need for more engineers in industry and civilian life is forced on us by the highly technical nature of our civilization. Engineers are continually creating new processes, products and industries, with the necessity of providing new plants. Mechanization of industry applies to almost every field. The ratio of engineer employees compared to overall population rose from 1 per 18,900 of population to 1 per 300 during the period 1900 to 1952. Engineers have become such a vital factor in industry that the projected demand will far outstrip the supply for years to come.

This difference between supply and demand can be alleviated to an appreciable extent through the greater utilization of available engineering man-hours. One important improvement would be obtained through the intelligent use of subordinate personnel. Such assistants would be high school graduates with technical backgrounds obtained in evening technical schools, on the drafting board, or in the shop. They would relieve the engineer of many routine duties such as drafting, calculating, keeping records, filing, checking, requisitioning, and simple corresponding. A careful analysis will disclose that an amazing amount of clerical and non-engineering work is now performed by engineers. This could readily be handled by non-engineering assistants under proper supervision. This arrangement would permit engineers to devote a much greater portion of their time to creative work and managerial operations.

The continued growth of our country, its strength and its safety, requires an ever increasing number of competent engineers and a full utilization of their professional abilities.

ALUMNI ENGINEERS

Colonel Carl W. Meyer, C.E. '28, is now in Heidelberg, Germany as deputy engineer of the U. S. Army in Europe. Colonel Meyer, whose wife and daughter live at 807 Delaware Avenue, Tampa, Fla., was formerly assigned to the Army Field Forces Board at Fort Knox, Ky.

Samuel C. Jones, Chem.E. '28, was married to Louise G. Isfort, M.A. '43, January 30, in Germantown, Pa. Jones is with Sun Oil Co., and Mrs. Jones teaches at National Cathedral School, Washington, D.C. Address: Brinton's Bridge, Chadds Ford, Pa.

Arch P. Smith, Jr., C.E. '29, has been appointed manager of duPont's neoprene synthetic rubber plant in Louisville, Ky. He joined duPont immediately after receiving his degree and worked in Wilmington as an engineer until 1932,

Walter B. Manson, Jr.

when he was transferred to the Chambers Works. There he advanced through engineering and supervisory assignments until 1952, when he was appointed assistant manager of the Louisville plant.

Julius F. Siegel, E.E. '30, is president of General Coil Products Corp., 43 Roselle Street, Mineola, manufacturers of electronic components and assemblies. He was formerly vice-president and director of engineering of Leonard Electric Products Co., Inc. Siegel is married, has two daughters, and lives at 34 Cloverfield Road South, Valley Stream.

Edward M. Tourtelot, Jr., B.Arch. '29, '31, of Mittelbusher & Tourtelot, Chicago architects and engineers, was the subject of an article in the December 21 issue of Time. The firm built a 200-man residence hall for McCormick Theological Seminary, Chicago, Ill., in record time (four months, five days) and for an unprecedented low cost. The contract was less than the estimate and the final cost was less than the contract. Address: 2718 Sheridan Road, Evanston, Ill.

Bruce W. Hackstaff, C.E. '31, has been appointed Director of the Department of Plant and Production for The F. & M. Schaeffer Brewing Co. Since his graduation, Mr. Hackstaff was associated with Max B. Miller & Co., Inc. for seventeen years engaged in Lubricating oil refining and research. Prior to his appointment as Director of the Department of Plant and Production, Mr. Hackstaff was Engineering Department and Packaging Manager for the Schaefer Brewing Co.

Bernard Falk, C.E. '32, was appointed district office manager of Metropolitan Life Insurance Co., 313 State Street, Perth Amboy, N.J., December 1. He moved last January to Warwick Road, Colonia, N.J.

Monroe D. Edelman, B.Chem.E. '33, is administrative assistant to director of research with The Glidden Co., Soya Products Division, Chicago, Ill. He is married and has three sons. Address: 2949 West Belden Avenue, Chicago 47, Ill.

Walter B. Manson, Jr., E.E. '35, has been appointed assistant division manager of the Ediphone Division of Thomas A. Edison, Inc., West Orange, N.J. He and Mrs. Manson (**Marilyn Brown '37**) live at 115 Lake Drive, Mountain Lakes, N.J.

Ralph M. Reahard, B.S. in A.E. (M.E.) '41, has been promoted from assistant manager to manager of the printing and label control department of Eli Lilly & Co., Indianapolis, Ind. He has been with the company since 1946. His address is 6969 North Penn Street, Indianapolis, Ind.

L. William Bertelsen III, Chem.E. '47, graduated from Harvard Law School in 1950 and is now a part-

Ralph M. Reahard

ner in the law firm of Kenway, Jenney, Witter & Hildreth, 24 School Street, Boston, Mass. He and Mrs. Bertelsen (**Joyce Cook '44**) and their son live at Glezen Lane, Wayland, Mass.

Howard A. Stevenson, Jr., C.E. '50, son of H. A. Stevenson '19, has a second son and third child, Jeff, born November 3. He now resides in Forest Home, Ithaca, where he is in the office of Thomas H. McKaig '11, consulting engineer and architect of Buffalo. Stevenson is acting as clerk of the works in construction of a $2,000,000 school in Bath.

David G. White, Chem.E. '50, finished his studies for his Ph.D. in inorganic chemistry at Harvard last August. He is now assistant professor of chemistry at George Washington University. His address is 2920 38th Street, NW, Washington 16, D.C.

Andy Mellen, Chem.E. '52 is with Esso and is berthed at Gooseneck Point, Little Silver, N.J. c/o Ralph L. Shearer.

NECROLOGY

William Conant Morgan, M.E. '06, Rindge, N.H., December 1,

1953. Before his retirement in 1950, he was a mechanical engineer with National Advisory Committee for Aeronautics, Langley Field, Va. Phi Delta Theta.

John Stearns, C.E. '06, January 21, 1954, at his home, 1805 Nichols Canyon Road, Los Angeles 46, Cal. He gained national recognition for his work on the Los Angeles aqueduct in 1919-20, the Pine Canyon dam for Southern California in 1932-38, and as principal engineer for the Federal Power Commission's power flood control surveys in 1938-39. Since 1943, he had been a plant engineer with Howard Hughes Aircraft Co., Burbank, Cal. Sigma Phi, Quill & Dagger.

George Kothe, M.E. '07, 1183 South Hayworth Avenue, Los Angeles, Cal., in June, 1953. He was manager of Insurance Credit Clearing Association. Phi Delta Theta.

Arthur William Engel, C.E. '09, 708 Hill Street, Sewickley, Pa., January 7, 1954. He had been an engineer with American Bridge Co., Pittsburgh, Pa., for forty-two years before retiring in 1951.

Retiring Board

(Continued from page 18)

through Europe.

Eventually Al hopes to return to his native Mount Vernon, New York and enter the building and construction business. In the more immediate future he must serve two years as a second lieutenant in the Signal Corps and then possibly return to school for some graduate work.

Robert S. Arlook, Chem.E. '54

Graduating this June with his B. Chem.E. degree is Bob Arlook, retiring circulation manager. Joining the CORNELL ENGINEER in his junior year, Bob worked on the Business Board until the spring term of his senior year when he became circulation manager.

Bob came to Cornell from Passaic, New Jersey, on a McMullen Scholarship. He is a member of Alpha Epsilon Pi and AIChem.E. Interest in photography and electronics have developed into a hobby for him.

Bob has spent a good deal of time this year working on his fifth-year project in Olin Hall. He is developing a new method for recovering maleic anhydride from its reactor. He is working on the entire purification process, using tricrecylphosphate as the extractor.

Since he is a member of Air Force ROTC, Bob will be spending his first two years after graduation in the Air Force.

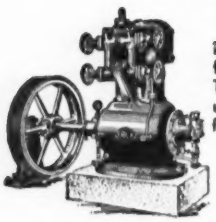
Robert Posner, M.E. '55

Retiring office manager this year is fourth year mechanical engineer Bob Posner. Bob has been active on the CORNELL ENGINEER Business Board since his freshman year.

Coming to Cornell from Whitestone, Long Island, on a McMullen Scholarship, Bob has been active in ASME and Alpha Epsilon Pi, and is a member of Pi Delta Epsilon, journalism honorary. He participates in golf, basketball, and other intramaural sports. His favorite sport is flying.

Bob worked this year on a senior project in ultrasonics. He will be serving two years in the Army Signal Corps after graduation next June.

Provides Five Services for Hotel William Penn



These include air conditioning, cooling drinking water, refrigeration of foods, freezer service, and making ice. This magnificent Pittsburgh hotel has used Frick equipment since 1936, and finds it both efficient and dependable.

The Frick Graduate Training Course in Refrigeration and Air Conditioning, operated over 30 years, offers a career in a growing industry.

DEPENDABLE REFRIGERATION SINCE 1853
FRICK & CO.
WAYNESBORO, PENNA. U.S.A.

THE CO-ED GETS A BREAK
AT THE NEW CORNELL CAMPUS STORE !

In the past, we haven't had much to offer the girls at Cornell but it's all different now. This Spring we have —

BERMUDA SHORTS

Wool flannel in Cambridge gray, Oxford gray and Navy Blue. To go with them, we have Knee-Hi socks in an assortment of colors and rubber-sole Keds with canvas uppers in white, charcoal, faded blue denim and navy blue.

ORLON SWEATERS

Orlon looks and feels like fine wool but it is washable, it drys in an hour and it holds it shape and never shrinks. Pull-overs and cardigans in white, blue, pink and maize.

WE WILL APPRECIATE SUGGESTIONS FROM YOU TO IMPROVE THIS DEPARTMENT WHICH HAS BEEN SET UP FOR THE GIRLS AT CORNELL.

THE CORNELL CAMPUS STORE
BARNES HALL

Case of the dry "oil" well

Not at all unusual, you say? But this well was *purposely* drilled that way! In fact, precautions were taken to see that the well wouldn't contact oil-bearing sands. It was to be a vital part of an elaborate waste-disposal system built into one of Du Pont's new plants near Victoria, Texas. It is an example of the unusual engineering problems which Du Pont technical men encounter.

The "well" itself is almost a mile deep—4900 feet, to be exact. Waste fluids from the plant are forced down this well, to be absorbed by non-oil-bearing sands—far below the level of any surface water. Piping near ground level is in the form of concentric shells, and fresh water is delivered to the annular opening around the waste pipe. Furthermore, the water pressure is higher than that of the fluids in the waste section. In this way, any leakage in the pipe system causes fresh water to enter the surrounding sands (or the inside waste system) and prevents objectionable materials from reaching the sands at surface levels.

Other interesting procedures are used throughout Du Pont's many plants to guard against river pollution. For example, scientists were asked to make a complete marine-life census on one river before a plant was built nearby. The company wanted to be certain that no waste would be discharged which would challenge the natural pattern of marine life.

Throughout the Du Pont Company, wherever there is a need for the services of technical men, there are varied and interesting problems that present a challenge to engineering skill and imagination.

Now available for student ASME chapters and other college groups, a 16-mm. sound color movie—"Mechanical Engineering at Du Pont." For further information, send post card to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Bldg., Wilmington 98, Delaware.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Watch "Cavalcade of America" on Television

College News

April 30 is E-Day

Curious about what the engineers do when they hide in the woodwork of the buildings up on the hill? Would you like to see some of the interesting projects and equipment belonging to the Chem. E's, M.E.'s, E.E.'s, C.E.'s, E. P.'s and Architects?

For the sixth consecutive year the Cornell Student Engineering Council will sponsor E-Day, a time when the members of the Cornell community and the general public are treated with views of the experimental and constructive sides of an Engineering School. To be held in conjunction with the annual open-house, Cornell Day, E-Day is set for Friday, April 30.

As has been the custom in the past, the program for Engineer's Day will include exhibits prepared by the students in the various schools and departments of the University. These will be arranged in Kimball-Thurston, Olin, Rockefeller, Sibley, Rand, Franklin, and Lincoln halls, and visitors will be conducted, at their convenience, throughout the campus.

A few of the exhibits last year displayed were: illustrative examples in Chemical and Metallurgical Engineering of basic welding problems and techniques, treatment of ores, melting and heat treating of steel, plastic and rubber chemistry; in Civil Engineering, some phases of sanitary engineering, such as sewage treatment and water processing, and in addition an unusually interesting demonstration of the soil mechanics of quicksand; Electrical Engineering students devised exhibits of communications, transistors, television, and radar equipment, and the production of electron tubes, including on-the-spot construction of small tubes; Engineering Physics opened its doors to visitors who wished to see some of the highly theoretical types of engineering. Elecron microscopes, low temperaure phenomena appratus, geiger counters, and experiments in shock wave research were operated and displayed. In Thurston and Sibley, the Mechanical Engineers demonstrated their materials testing equipment, heat-power projects, several giant diesels, as well as a few of their Industrial Engineering projects. The Architects included all phases of instruction, samples of drawing, structural design, and large scale city planning.

This year, work is already well under way for an exciting and successful E-Day, as last year's was. It is hoped, in addition to the above exhibits, that the use may be obtained of the Cornell Radar Truck, to be set up in the middle of the Quad to demonstrate by actual operation the "vision" made possible by electronic circuits. If its schedule permits, the powerful newly constructed Cornell Syncrotron will be in operation for the benefit of guests at the Newman Laboratory of Nuclear Studies.

In charge of the E-Day program are Bill Millager, EE '54; Bill Sperry, ChemE '54; Rober Waugh, MetE '54; Dick Harwitz, EP '55; Lee Richardson, ME '54; Fred Reidenback, ME '55; Marty Rosenzeig, CE '55; Bob Kahle, Publicity '55; Len Mende, General Chairman '55, and Mr. and Mrs. John F. McManus, faculty advisors.

Climaxing the weekend will be the annual Engineer's Banquet, at which awards for the best groups projects and exhibits will be presented to the students of the winning schools. Other awards presented at the banquet in the party have been the Fuertes Memorial Prize in Public Speaking, The Fuertes Medal, the Sibley Prize in Mechanical Arts, and the Charles Lee Crandall Prize.

Last year more than 5000 visitors, many of whom were high school students and "sub-freshmen," came to Cornell for the program. Each season Cornell receives increasing numbers of inquiries about Engineer's Day: chances are that many of our freshmen have been first attracted by what they saw in an E-Day tour.

The CORNELL ENGINEER extends to you an enthusiastic invitation to be up on the Hill April 30. We are confident you will enjoy yourself in becoming more familiar with the work in our vast field of science and engineering development. The exhibits will be open from 7 until 11 o'clock, in the evening.

Dr. Bethe Elected President of A.P.S.

Dr. Hans A. Bethe, John Wendell Anderson Professor of Physics at Cornell, is the new president of the American Physical Society.

He was installed on January 31 during the society's annual meeting in New York City.

Professor Bethe left his native Germany in 1933, went to England, and came to Cornell in 1934. During World War II he headed the theoretical physics division at the Los Alamos laboratory where research on the atomic bomb was conducted. He also made intensive studies of the propagation of shock waves in matter.

CRESCENT SERVICE CABLES

Employ EDURITE

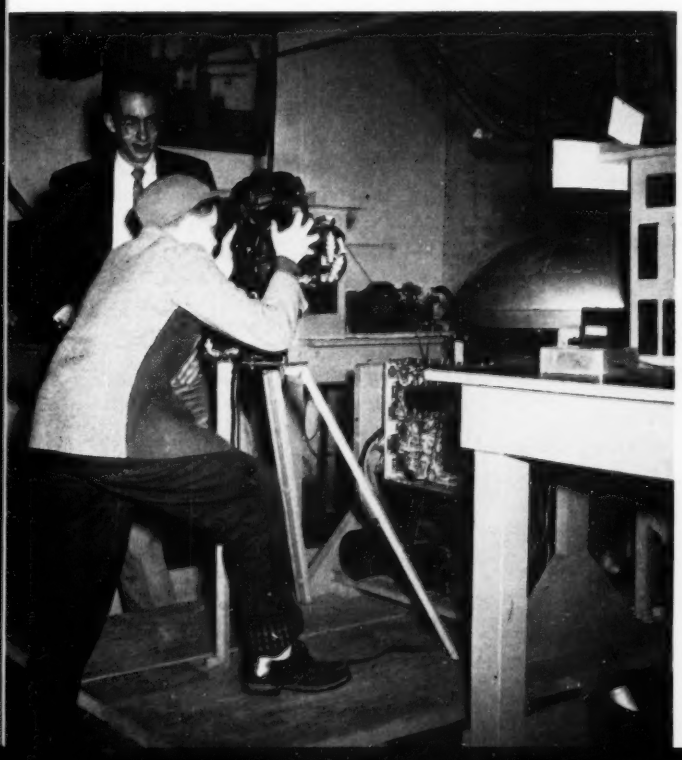
Heat Resisting Insulation

• CRESCENT Service Cables, sizes No. 6 AWG and larger, are insulated with a Type RH, Crescent ENDURITE super-aging, heat-resisting rubber compound of the best grade obtainable that gives *20% greater current carrying capacity* than ordinary grade insulated cable.

CRESCENT INSULATION WIRE & CABLE CO.
TRENTON, N. J.

OVER 70 YEARS EXPERIENCE

Engineer's Day Exhibit of an automatic amplidyne fire-control system, used in B-29's and B-50's.



Cornell Engineering College equipment that will be on display Engineer's Day includes this helium cryostat, a device for liquifying helium.

He was the first physicist to detail an adequate explanation of the source of solar energy, and has made significant contributions to the theory of interaction of radiation and electrons.

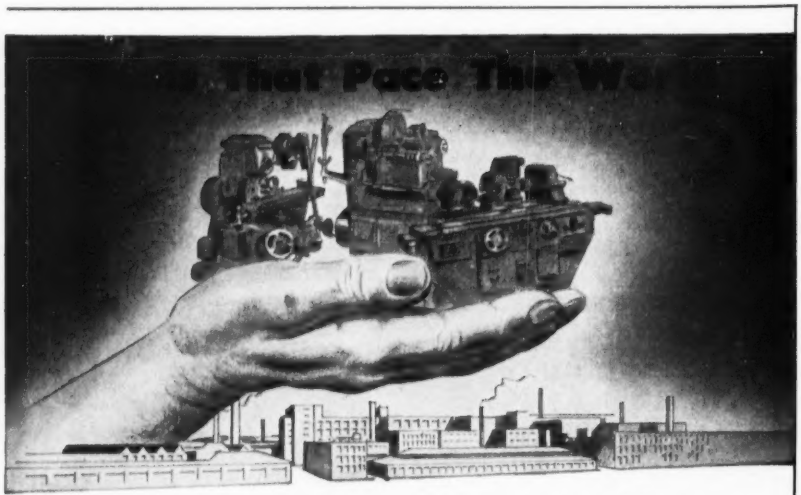
Professor Bethe holds honorary degrees from the University of Chicago, Brooklyn Polytechnic Institute, the University of Denver, and a number of other awards.

IRE Hears Talk On Neculear Power

Dr. Lloyd V. Berkner, President of the Associated Universities, Inc, presented the engineering aspects of nuclear power in his speech before the Ithaca section of the Institute of Radio Engineers on Feb. 26. Dr. Berkner, chairman of the Geophysics division of the National Academy of Science, asserted that today's engineering students will be among the operators of the first large scale power-reactor station. He stated that it is now estimated that of the recoverable fuels in the United States from ten to one hundred times more energy is available in stores of thorium and uranium than in the coal supply.

Dr. Berkner defined the basic structure of the atom, and the conditions involving the bombardment of an atomic nucleus with a neutron particle. He explained the meaning of cross-section, or neutron-nucleus resonance, and indicated the importance of the phenomona in the selection of reacter materials, based on their scattering cross-section or high-capture cross-section properties. Dr. Berkner enumerated the seven basic elements of a nuclear reactor, including a neutron source, a fuel of either uranium isotope or plutonium, a moderator, a control system, a heat transfer system to remove thermal energy from the reactor, a source of shielding, and a breeder or reflector. By means of slides, Dr. Berkner showed the variety of reactor configurations, including the air-cooled reactor, reactors cooled by water and deuterium, and liquid-metal cooled reactors. Dr. Berkner discussed the Brookhaven reactor, which is operated by the Associated Universities to obtain fundamental facts about nuclear energy. The Brookhaven reactor, of the natural uranium, air-cooled, graphite-moderated type, produces about a cubic centimeter of electrons each year according to Dr. Berkner.

In discussing the three products of nuclear reactors, heat, fertile material, and isotopes, Dr. Berkner predicted that while isotopes or so-called debris is at present waste, there may be use for these products in the future. In outlining the costs of nuclear power materials, Dr. Berkner estimated that while uranium ore costs $3.50 per ton and $35 per ton when refined, attempts to separate the ore into U-235 and U-238 would boost the cost to the order of $10,000 per pound. He showed how breeding could reduce the cost of nuclear power to 1.3 mils per kilowatt hour, less than that of coal, and if 100% breeding were possible, cost would be reduced to .013 mils per kilowatt hour. In concluding, Dr. Berkner explained the potentialities of engineering research into the unique properties of the unusual metals suitable for reactor useage, pointed out the need for long range research to establish necessary amortization figures based on the length of time an expensive reactor will operate, and asserted that as many as a dozen reactors will be built within the next five years.



Mass production is the key to America's industrial development and every manufactured need can trace its beginning back to machine tools and precision measuring tools.

For over a century the Brown & Sharpe Mfg. Co., old in experience, young in ideas, has been working for the present but planning for the future; producing the machine tools and precision tools that set the pace for the nation's progress.

The long list of products includes Milling, Grinding and Screw Machines as well as Machinists' Tools, Electronic Measuring Equipment, Johansson Gage Blocks, Cutters, Pumps, Vises, Permanent Magnet Chucks and numerous shop equipment and accessory items.

For information write Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Brown & Sharpe B&S

Sigma Xi lecture On Color Television

An explanation of how color television can be received on the same sets as black and white TV was given by Karl R. Wendt, Buffalo electronics consultant, in a Sigma Xi lecture at Cornell on February 11 in Rockefeller Hall.

The talk was sponsored by the radio and television division of Sylvania Corporation. Speaking on "Color Television: Product of Eyes and Imagination," Mr. Wendt discussed how our eyes see color, and showed some experiments on color vision. He discussed also the National Television Committee standards, which provide for a system that is compatible with the present black and white standards, that do not require a wider band, and that supply all the information necessary for complete color reproduction.

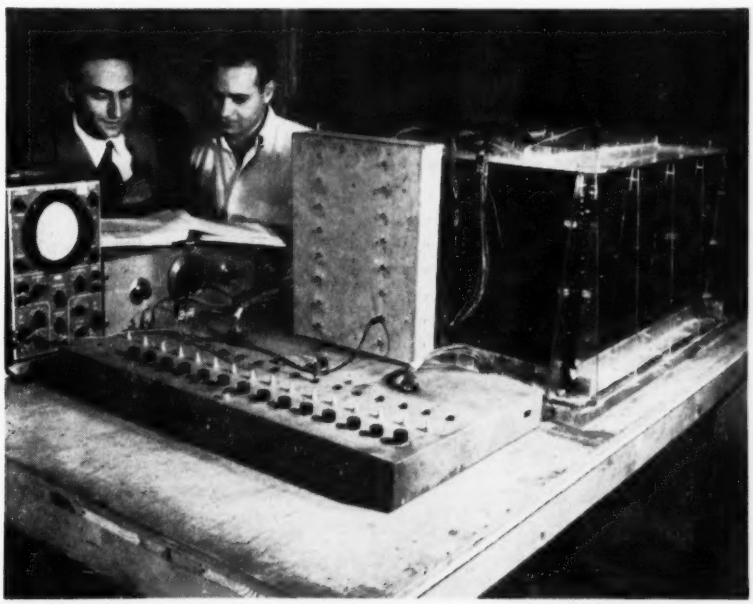
After graduating in 1929 from the University of Wisconsin, where he majored in chemistry, Mr. Wendt was a research chemist with the Sun Oil Company. He entered radio and television research with the RCA research department in 1942.

New Air Flow Simulator Developed at Cornell

By means of an "electric wind tunnel", researchers at the Cornell University Graduate School of Aeronautical Engineering can now determine how forces act on an airplane wing in a fraction of the time it takes in a conventional wind tunnel or by computational methods.

The new device simulates the flow of air by passing electricity through liquid.

Described as being extremely accurate as well as fast, the analyzer gives engineers the lift pattern for any wing shape at any sub-sonic speed.



New simulator, developed in the Graduate School of Aeronautical Engineering at Cornell by Prof. Nicholas Rott (left) and Joseph T. Corso, will aid research on airplane wings.

The device, which basically resembles a large rectangular goldfish tank, is expected to be useful to industry in the study of new and unconventional wing designs. Its relative simplicity and speed are said to make it superior to a conventional wind tunnel for many types of problems.

Built by Prof. Nicholas Rott and Joseph T. Corso, a graduate student, the Cornell device is believed the first of its kind in the United States, although the same idea was first proposed in France.

Dr. Furnas Received Dept. of Defense Position

Dr. C. C. Furnas, Director of Cornell Aeronautical Laboratory, Inc., of Buffalo, has been appointed Chairman of the recently-formed Technical Advisory Panel on Aeronautics of the Department of Defense. Dr. Furnas was appointed to the post by Donald A. Quarles, Assistant Secretary of Defense for Research and Development.

The Panel, composed of civilian scientists and experts, was formed to insure that the country's finest scientific and technical talent are applied to planning and carrying out military research and development in aeronautics. Reporting directly to the Assistant Secretary of Defense for Research and Development, the Panel will develop technical advice as required in the fields of airframes, propulsion systems, aerodynamics, equipment and components for both piloted aircraft and guided missiles. This advisory panel will work closely with the various military committees responsible for the actual execution of research and development programs.

To be successful, a product design must first be simple ...inexpensive to produce.

HOW TO ELIMINATE COSTLY OPERATIONS IN DESIGN

BEFORE any design is acceptable, methods and costs of production are carefully studied. Every needless expense in material and machinery is eliminated to meet price demands of competition.

By using steel instead of cast iron, substantial savings in material can be realized. Steel is three times stronger, 2½ times as rigid as iron. As a result, only one-half to one-third the amount of metal is needed with steel. Also, steel costs only one-third the price of iron, pound for pound.

In manufacture, welded steel components can be produced today at an average of 50% less cost. Production methods are simpler . . . fewer man-hours are involved with arc welding.

With welded steel construction, ultimate savings are limited only by the ingenuity of the designer. For this reason, every product engineer needs to keep in step with the rapid progress in low cost manufacturing with arc welding.

Motor Swing Base *is fabricated at low cost from tubing and steel plate. Welds are made with "hidden-arc" process in agglomerated flux, using Manual Lincolnweld.*

DESIGN AIDS FOR LOW COST

Principles of designing or converting existing products in welded steel are presented in Lincoln Weldesign Manual available at nominal cost for hours of study. Write for free design bulletins to

THE LINCOLN ELECTRIC COMPANY
Cleveland 17, Ohio
THE WORLD'S LARGEST MANUFACTURER OF ARC WELDING EQUIPMENT

Technibriefs

New Developments in Industry

A two-seat trainer version of the Air Force F-86 Sabre Jet is undergoing flight evaluation by North American Aviation. The prototype is the nation's first trans-sonic trainer, and is designed for advanced pilot training in high speed flight, gunnery, and dive bombing.

In building the trainer, North American engineers added a tandem cockpit, dual controls and a duplicate instrument panel to the original installations of the Air Force F-86F fighter-bomber. The fuselage section between the nose and wing roots was extended 63 inches. A proven airframe was used for conversion to a high speed trainer to reduce costs of development and production and to provide a ready store of spare parts and trained maintenance personnel.

It is rated in the 650 miles per hour class, has a maximum service ceiling of 45,000 feet and a combat radius of over 600 statute miles. In converting the F-86F to the trainer North American engineers returned to the slatted leading edge of earlier Sabre models. The moveable edge reduces stalls at low speeds and allows the trainer to make slower landings. Safety features of the trainer include separate ejection controls for both the hinged canopy and the seats, and a seat belt that automatically opens after ejection. Provision has been made for the installation of two .50 caliber machine guns for gunnery practice.

New Silicon Rubber Developed

Super-Tough Silicone Rubber has been developed by the General Electric Company for aircraft, chemical processing, and similar rugged applications.

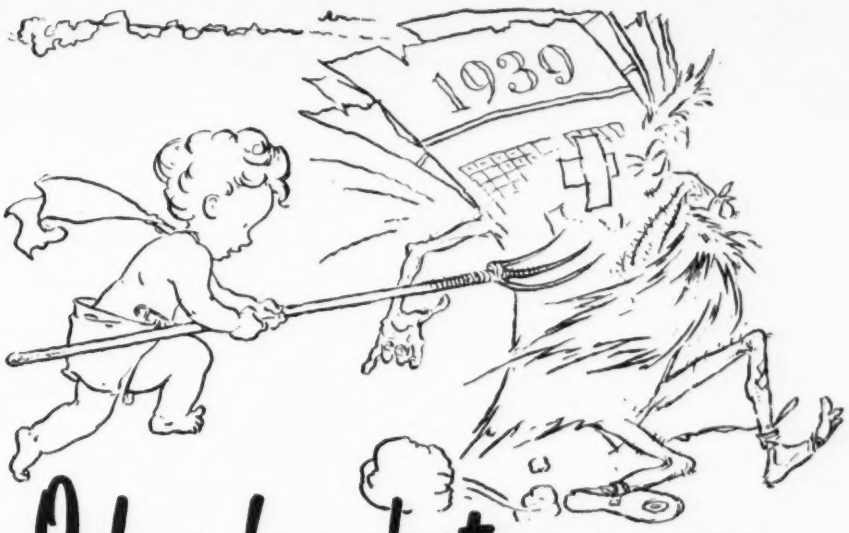
Available in three grades, the new elastomer's tear strength, averages 190 psi., 2 or 3 times higher than any other silicone rubber now on the market. One grade has very low compression set properties and all grades have excellent resistance to both heat and cold. Flexibility is maintained over a range of minus 60°F to 550°F. Super-Tough has been put into production to provide industry with a material that has the best thermal properties of silicones, but with greater tear strength and oil resistance.

The rubber has successfully survived rigorous flight tests in jet engines and other aircraft equipment. "O" rings and gaskets, made from this type rubber, have proved satisfactory as seals for synthetic base oils at temperatures as high as 375°F. Super-Tough is recommended for molded ducts and connectors for hot air lines, particularly where oil mist is present. In addition to aviation applications, Super-Tough is expected to find wide spread use as a gasketing material in chemical processing equipment, where high temperatures, pressure, or vacuum exist.

Mechanical Miner Does Construction Work

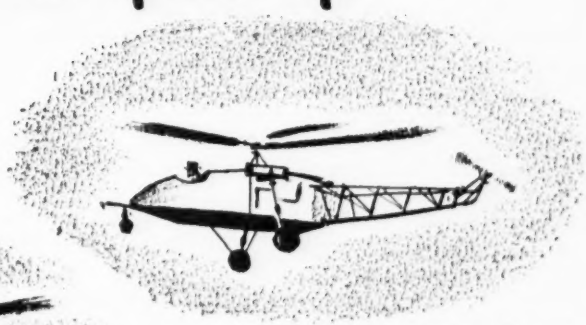
Mechanical miners, designed for use in the coal fields, are proving

The new TF-86 jet, a training version of the famed Sabre, undergoes flight evaluation near Los Angeles, California.



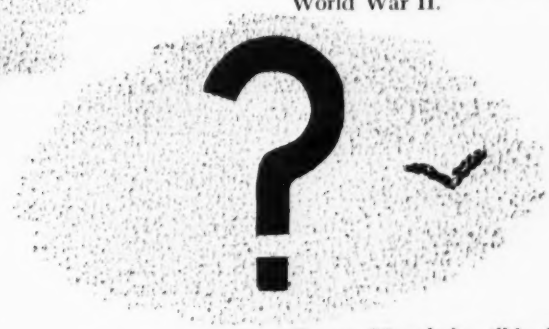
Only a few short years ago

the helicopter was thought to be a "stunt" machine — amazing and amusing, and not particularly important. Events in Korea changed that idea — fast! This fledgling among aircraft performed "impossible" military assignments, spectacularly successful missions of mercy. Helicopters came into their own.



In 1939, the VS-300 with Igor Sikorsky at the controls made the first practical helicopter flight in the United States. Hundreds of later Sikorsky's were delivered for service in World War II.

Now in demand for hundreds of jobs, today's most versatile flying machine is the product of ceaseless testing, highest-calibre engineering, work and imagination.



Future Sikorsky's will be built by tomorrow's engineers. Perhaps *you* belong at Sikorsky where your skill and ability will be continually challenged.

You might find — in Sikorsky Aircraft's research departments, drafting rooms, engineering laboratories — a lifetime opportunity in this young, growing and most interesting field of aviation. Write today to R. C. Banks, Personnel Department.

SIKORSKY

Sikorsky Aircraft, one of the four divisions of United Aircraft Corporation, South Avenue, Bridgeport 1, Conn.

effective in underground construction jobs, Construction Methods and Equipment, a McGraw-Hill publication, reports.

One such machine, being used to dig a 2,800-foot water tunnel beneath the Arkansas River, is doing the job twice as fast as it could be done by conventional methods. Pushing through shale, the machine is advancing a 7x12-foot bore an average of 20 feet in eight hours, but best progress is nearly double that figure. Further planned remodeling of the mining machine is expected to result in a minimum 30 per cent increase in its efficiency and in the addition of ten feet to the average daily advance. The total underground crew required is five men. The main digging elements of the machine are two propeller-like rotating cutter-arms on the front, each driven by a 75-horsepower electric motor. The machine is supported by a sledge runner at each of its four corners. These are fitted with hydraulic jacks so that the machines can be raised, lowered or tilted in any direction.

In a similar operation reported by the magazine, a continuous mining machine was used to dig a sewer tunnel. It cut a 12-foot circular bore through medium-hard shale at well over 20 feet per eight-hour day. In this instance, employment of the machine also silenced complaints of near-by residents who objected to noise and claimed damage to their homes from the routine drilling and blasting method used at the start of the job.

Army Develops Mobile Water Purifier

A mobile water purification unit has been developed by the Army Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Virginia.

The unit is truck-mounted and electrically operated. It will treat, clarify, filter and distribute 3000 gallons of water an hour in temperatures as low as 40 degrees below zero. After pumping in polluted water it takes about 20 minutes before drinking water is discharged. One man is required to operate the unit and three can put it into operation in less than 90 minutes. Under emergency conditions, where only water for drinking and cooking needs can be considered, one truck-mounted unit would be capable of supplying the curtailed needs of a community of nearly 50,000 people.

At present the unit is undergoing extensive field tests in the West and Mid-West. The sites selected for service testing the equipment include Bear Lake, Utah, the Mississippi and Illinois Rivers, and Fort Knox, Kentucky. Mile-high Bear Lake was chosen to test the operation of the unit at high altitude. The Illinois locations will give the Engineers a pretty good idea of how the unit will operate during a typical midwest winter. At Fort Knox the purifier will go throught its paces over rough and rugged terrain.

Although developed for use by military forces in the field to purify water under combat conditions, the unit is finding extensive application to community and industrial problems.

Television Camera Counts Microscopic Particles

The television camera has been turned into the eye of a computer to count microscopic particles such as blood cells, bacterial cultures or grains of photographic emulsion. The system, known in its laboratory stage as the Sanguinometer, was developed by engineers at the David Sarnoff Research Center of RCA in Princeton, N.J., working in close cooperation with the Sloan-Kettering Institute, research unit of the Memorial Center for Cancer and Allied Diseases, in New York.

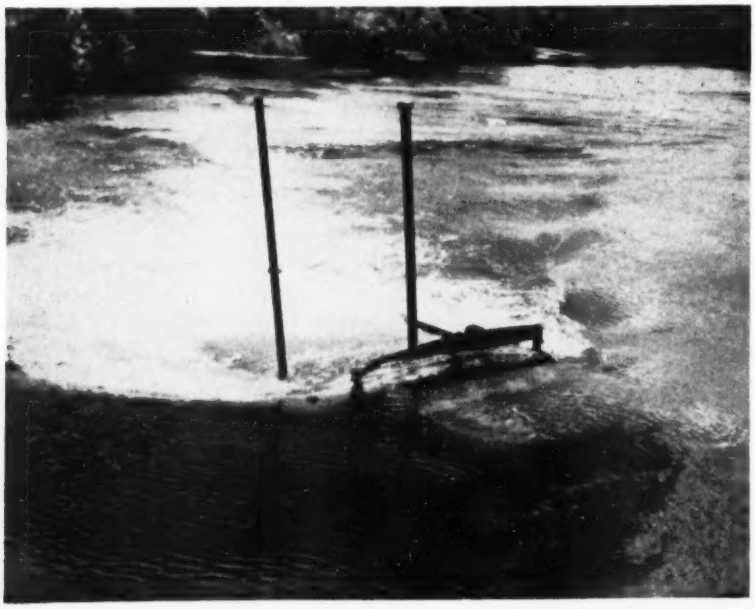
The equipment was devised to provide a simple, rapid and accurate mass method of taking blood counts to detect the first signs of radiation sickness among persons in the target area of an atomic bomb.

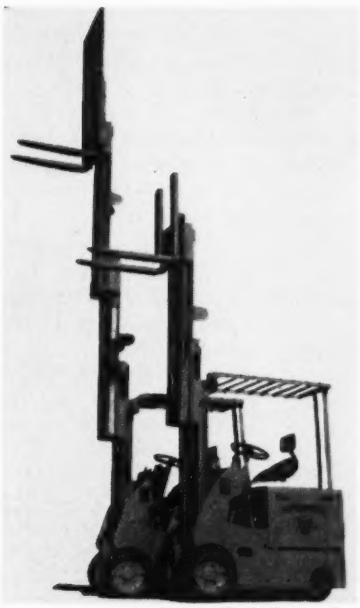
The Sanguinometer is essentially a closed-circuit industrial television system combined with an optical microscope and a computer that can make a count of particles in a given field.

In operation, the camera tube of the specimen under the microscope sends out video pulses as the scanning beam strikes the images of the particles to be counted, and the pulses in turn actuate an electronic counter. The beam scans its field of vision from side to side, progressing downward in a series of parallel lines. The lines are so close together that in a normal microscope magnification each particle to be counted interrupts several lines as the scanning beam moves across the field, and consequently produces several pulses in the output of the television system. Large particles will interrupt more lines and

The Army's newest truck, the M-135—made by GMC—tows a 5000 lb. cannon while riding underwater. The M-135 has Hydra-Matic drive.

—Courtesy GMC





—Courtesy Harishe-Rotman, Inc.

This new fork truck with "triple telescope" permits tiering to 198 inches. Similar truck (right) allows only 132-inch tiering.

produce more pulses individually than will small ones. To enable the counter to distinguish between a large number of small particles or a small number of large ones a diameter compensation circuit was developed that is able to determine the average size of the particles by taking account of a direct relationship between the average time duration of the pulses and the diameter of the particles. This indicates the number of video pulses created by each particle, a figure that is electronically fed to the counter where it divides the total number of pulses to give an automatic reading of the actual number of particles.

One great advantage of the device is its ability to take account of non-uniform distribution of particles. Readings taken by the Sanguinometer at various points over the surface of a given specimen were found to vary by as much as 20 per cent, since blood cells or other particles generally are distributed unevenly in any given sample. The computer, however, can easily take a number of readings and permit an average to be arrived at rapidly, a process which would be prohibitively laborious and time-consuming in manual counting.

The Sanguinometer has indicated in tests that it is capable of handling with only a small margin of error a count of many varieties of microscopic particles as long as the particles within any one specimen are nearly uniform in size. It is not suitable for counting particles whose sizes and shapes vary widely in a single specimen.

New Infrared-sensative Film Developed

An infrared-sensitive motion picture film which permits motion pictures to be made in the dark with infrared illumination, or in the semi-dark without, has been developed by the Eastman Kodak Company.

In tests conducted at the University of Rochester successful motion pictures were made of audience reactions when house lights in a theatre were dimmed to 1/70th of normal room illumination. The film can be used in any standard 16 or 35mm motion picture camera accepting roll film or 16mm magazines. It will not be available in 35mm cassette loadings for 35mm still cameras. Lengths over 100 ft. will require the acceptance of spliced rolls.

WE ADMIT in spite of our every effort to keep stocks at a high level there are times when we cannot give you across the counter service.

WE INSIST we can and will promptly order anything you want that is in our power to obtain.

WE HOPE you will always visit the Triangle assured of satisfaction.

ENGINEERING DEPT.

TRIANGLE BOOK CO-OP

Evan J. Morris, Proprietor

412 College Avenue Sheldon Court

Serving Cornellians Since 1903

Fraternities Sororities

Attention

for

INVITATIONS

RUSHING BOOKS

SONG BOOKS

FRATERNITY PAPERS

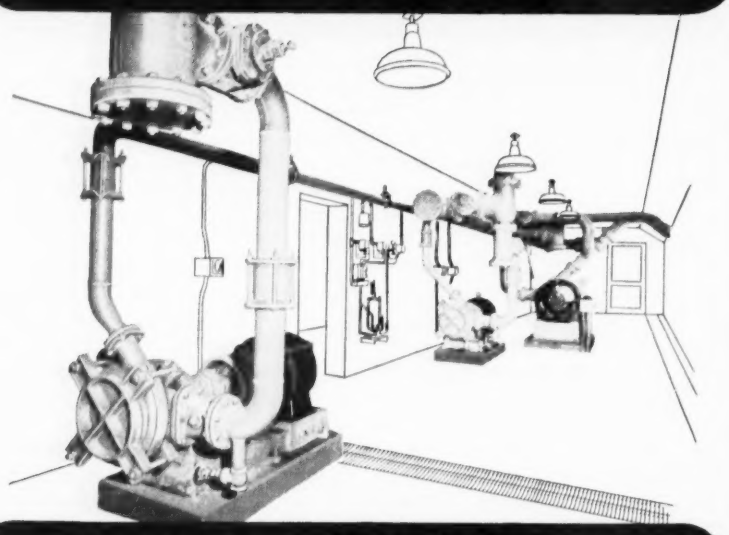
Stop At The

Norton Printing Co.

317 E. State St.

Opposite the Strand Theatre

Handles extremely thick slurries with high specific gravities



MORRIS Type R SLURRY PUMP

Heavy viscous slurries with solids ratios as high as 70% by weight are not unusual loads for a Morris Type R Slurry Pump.

A case in point is this Morris installation at the Missouri Portland Cement Co., St. Louis, Mo. The two Morris 3R Pumps in the foreground each handle 200 GPM of a cement slurry at 64% solids with 1.66 specific gravity. Speed is 1180 RPM. The 6R Pump in the background handles 600 GPM of the same slurry at 880 RPM.

Long operating life... little or no maintenance

Massive running parts of the Type R compensate for the increased load imposed by high specific gravities. Hydraulic passages are deliberately designed for high concentrations of solids—the result of careful study of wear patterns shown by pumps in the field handling all kinds of abrasive materials. Elimination of areas of throttling and turbulence assures uniform wear of all parts.

There are no internal studs or bolts—no troublesome internal joints and fits. The suction disc liner is merely *clamped* into position between disc and shell. The absence of high stress on the shell permits wide variations in its composition—including materials of high abrasive resistance—to resist wear and extend the operating life of the pump.

Let our engineers consult with you on your slurry pump problems. They'll give you the benefit of 88 years of pump-building experience. Or, write for Bulletin 181.

MORRIS MACHINE WORKS
Baldwinsville, New York
Sales Offices in Principal Cities

MORRIS *Centrifugal Pumps*

Known as Kodak Spectroscopic I-N Film, the film was originally intended for use by spectrographic laboratories. It is now being used for many other purposes such as audience reaction and ultra-speed camera photography where its sensitivity to the infrared range of the spectrum makes it particularly valuable for recording without supplementary illumination the flow and action of molten or hot metals.

Development results in a photographic negative which must be printed on another piece of film to produce a positive print for projection purposes.

Ultar-sonic Burgular Alarm

A burglar alarm that uses inaudible sound to detect intruders by their motion is manufactured by the Alertronic Corporation, Long Island City, N.Y.

Operating on the principle of magnetostrictive vibrations, the supersensitive burglar alarm reports any disturbance of the ultra-sonic waves transmitted within an enclosed area.

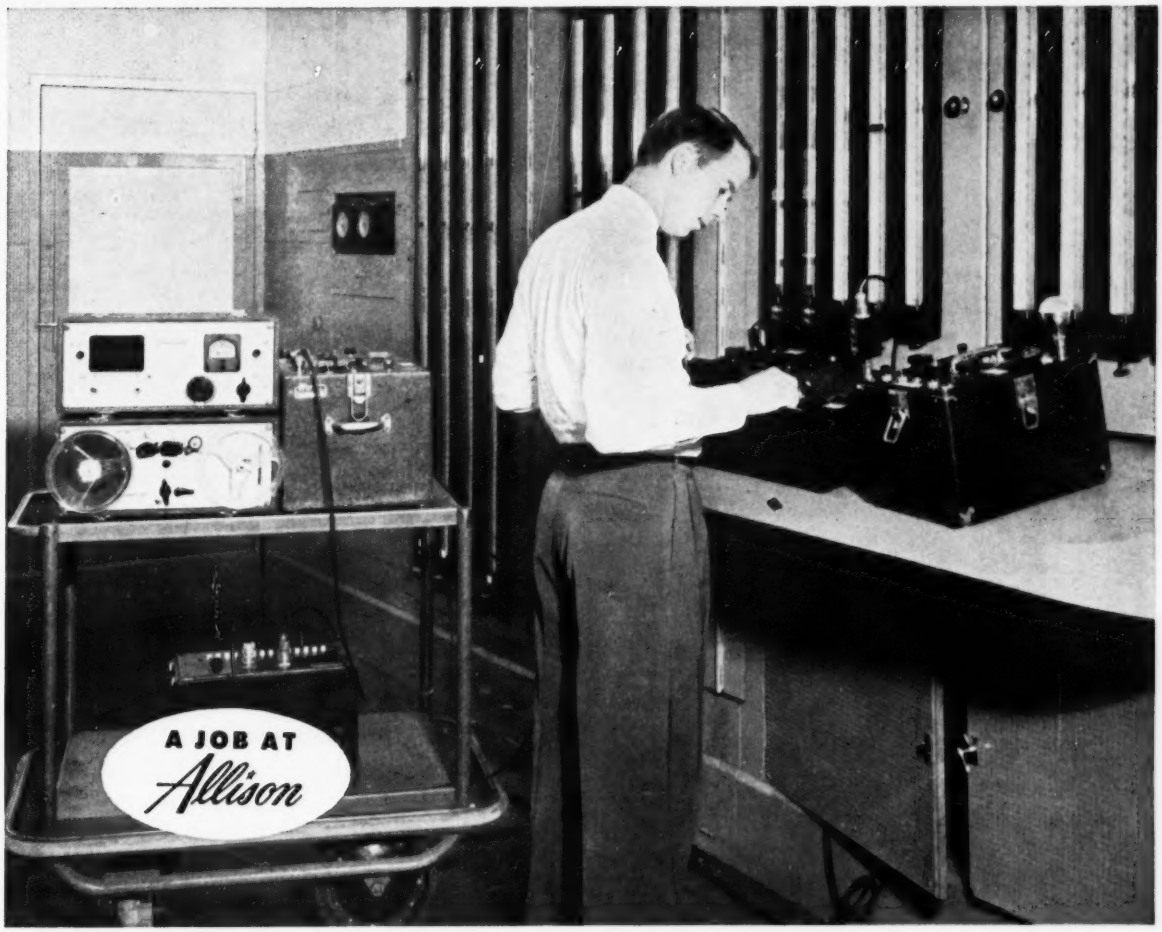
The Alertronic system consists of two can-like diaphragms, mounted on opposite walls; one generates ultra-sonic waves, the other receives them. Any motion that disturbs the waves causes the receiver to transform the sound into electricity and sound the alarm.

The system is usually set to detect a body the size of a child's, but it can be tuned to detect a deep breath, a wink of an eye, or the masses of air set in motion by fire.

Ultra-sonic vibrations are generated from four thin nickel rods, riveted to the bottom of the diaphragm and wound with copper wire to set up a magnetic field. As the rods shrink and relax, 19,200 times per second, they vibrate the diaphragm which sends out waves.

Nickel is the most widely used of the metals that have the magnetostrictive property that utilizes an alternating magnetic field to get contraction and elongation.

The system has been found to kill mice and temporarily drive rats away. In plants, mice were found with their skulls crushed, indicating they raced around in a frenzy until they hit something and died.



● Robert (Bob) McNew was graduated from Purdue University in 1950 with a B.S. in "double E."

He came to Allison the next year and currently is in the Instrumentation group, Electronics and Parts Test Department.

It's partly through his efforts that Allison has enjoyed considerable success in reducing noise conditions affecting both in-plant employes, as well as residents living in the vicinity of the Allison plants in Indianapolis. For example, noise coming from turbo-jet engines while on test stands now is being reduced in intensity by a ratio of 100,000 to 1 before it reaches the outside of the test cells.

In the photo above, Bob is adjusting the sound level indicating and recording instruments in preparation for measuring the silencer attenuation of a turbo-prop engine test cell. Equipment includes the latest type of general radio sound-level meter and octave-band noise analyzer, and the magnecord tape recorder.

The Allison equipment for instrumentation and testing is of the best. These complete facilities offer the young graduate engineer every opportunity for applying—and expanding—his technical training in his chosen field of engineering.

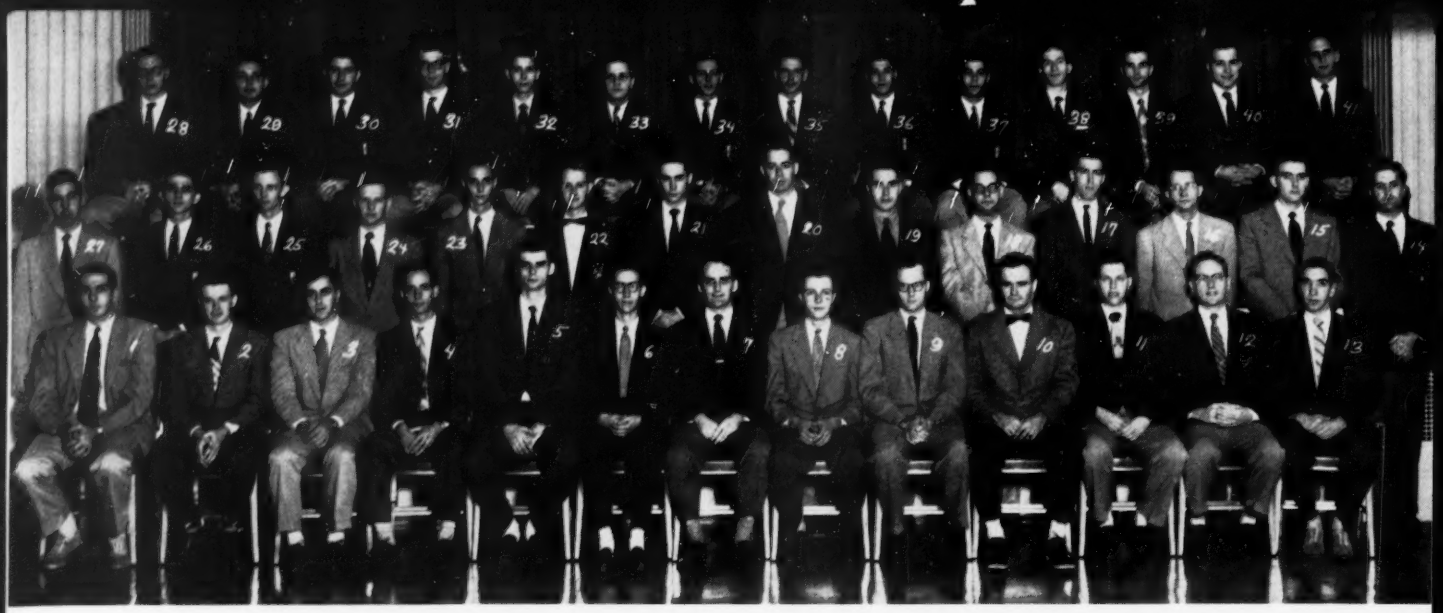
• • •

Allison, a leader in the field of turbine engine design and production, needs young engineers with degrees in Mechanical Engineering, Electrical Engineering, Aeronautical Engineering and Industrial Engineering. Right now—while you're still in school—it isn't too early to plan for your engineering career at Allison.

For further information about YOUR engineering career at ALLISON, discuss it with your Placement Counselor and arrange for an early interview with the ALLISON representative the next time he visits your campus. Or, write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

Allison **DIVISION, GENERAL MOTORS CORPORATION • Indianapolis, Ind.**

Design, development and production—high power TURBINE ENGINES for modern aircraft . . . heavy duty TRANSMISSIONS for Ordnance and Commercial vehicles . . . DIESEL LOCOMOTIVE PARTS . . . PRECISION BEARINGS for aircraft, Diesel locomotives and special application.



SCHOOL OF ELECTRICAL ENGINEERING

1. Thomas, S.
2. Schuetz, R.
3. Colbert, C.
4. Fowler, R.
5. Anderson, L.
6. Noden, D.
7. Goodwin, R.
8. Cane, J.
9. Stockdale, N.
10. Keeton, T.
11. Snyder, M.
12. Boardman, A.
13. Stuckelman, R.
14. Falknor, F.
15. Beilman, D.
16. Downey, P.
17. Greer, D.
18. Taggart, G.
19. Bingham, T.
20. Wintriss, G.
21. Ewart, D.
22. McCormack, J.
23. Blancke, T.
24. Dimmler, H.
25. Noonburg, W.
26. Kraemer, G.
27. Chamberlin, R.
28. Millager, W.
29. Simon, R.
30. Bardash, M.
31. Ashley, G.
32. Flattau, T.
33. Flory, R.
34. Simon, W.
35. Simon, D.
36. Schnog, A.
37. Schnog, N.
38. Arons, L.
39. Knickerbocker, L.
40. Arnold, J.
41. Jones, C.

CLASS OF 1954

SCHOOL OF CIVIL ENGINEERING

1. Quartararo, A.
2. Parasiliti, S.
3. Sai, M.
4. Gray, B.
5. Reid, L., Class Advisor
6. Christensen, N., Director
7. Grantz, W.
8. La Fave, I.
9. David, J.
10. Hobelman, C.
11. Howell, F.
12. Evans, C.
13. Okes, S.
14. Dunlap, W.
15. Jenkins, P.
16. Dunbar, R.
17. Albers, W.
18. Ready, R.
19. Leyh, G.
20. O'Connor, C.
21. Robey, W.
22. Wise, S.
23. Berman, M.
24. Strehlow, R.
25. Thomas, J.
26. Holland, S.
27. Youngdahl, I.
28. Shepard, R.
29. Walker, J.
30. Symons, J.
31. Cottrell, S.
32. Cohen, J.
33. Kelly, N.

LAVA

Manufacturers of Super-Refractories Only

◇

Refractory Crucibles
Graphite Crucibles
High-Temperature Cements
Special Refractory Brick, Tile, Shapes

◇

From the Following Materials:—

GRAPHITE —— SILICON CARBIDE
FUSED ALUMINA —— MULLITE
MAGNESIA ZIRCON

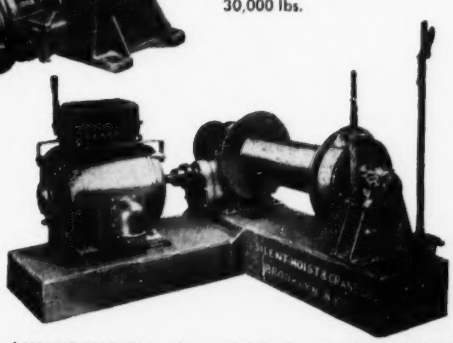
◇

Lava Crucible-Refractories Co.
PITTSBURGH, PA.

CAR PULLERS, BARGE MOVERS
ELECTRIC, GASOLINE, DIESEL

Let ***Silent Hoist*** Car Pullers, electric, gasoline, and diesel driven Winches serve you. Power-driven Capstans, Gypsies, and single and double Winches for all materials-handling applications — rigging, skip hoists, maintenance, construction, cable ways, etc.

CAPSTAN 6 Sizes: Draw Bar Pull Capacities	DRUM WINCH 4 Sizes:
2,000 lbs.	6,000 lbs.
6,000 lbs.	12,000 lbs.
12,000 lbs.	24,000 lbs.
18,000 lbs.	40,000 lbs.
22,000 lbs.	
30,000 lbs.	



Mfrs. of ***KRANE KAR*** *Swing-Boom Mobile Cranes,* ***LIFT-O-KRANE*** *Fork Lift Trucks, Cranes for Motor Trucks, Capstans, Gypsies, Single and Double Drum Winches, Coal Slicer Hoists.*

SILENT HOIST & CRANE CO.
841 63rd Street Brooklyn, New York

The two products illustrated presented the same problem — how to carry rotary movement around a turn. The designers might have done it with combinations of straight shafts, universals, bevel gears and other mechanical elements. Instead, they saved parts and costs by using S.S.White Flexible Shafts, and they eliminated a lot of unnecessary assembly time and operations in the bargain.

* * * * *

Many of the problems you'll face in industry will deal with the application of power drives and remote control with cost being an essential factor. That's why it will pay you to become familiar with S.S.White Flexible Shafts, because these "Metal Muscles"® offer important savings in transmitting power or control.

SEND FOR THIS FREE
FLEXIBLE SHAFT BOOKLET

Bulletin 5008 contains basic flexible shaft facts and shows how to select and apply flexible shafts. Write for a copy.

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO. Dept. C, 10 East 40th St. NEW YORK 16, N. Y.

Civil Defense

(*Continued from page 14*)

chief for coordination of the emergency repair operations of his company. Employees of the local utilities form the nuclei of the civil defense power, gas, water, sewer and sanitary services, but the number of their repair and operating crews is augmented by volunteers where practical.

Mutual aid arrangements usually exist between branches of the same utility within the state and between similar utilities in the adjoining states. In a heavy enemy attack this assistance might well be the major factor in restoring the damage to local utility company facilities. Therefore, mutual aid among utility companies is given special attention. The present line organizations of the utility companies are used as a basis for the new emergency organizations, with assignments of additional duties and responsibilities to selected personnel at strategic locations in the systems. The utility liaison officials in the civil defense organization work closely with the utility companies' civil defense coordinators. In some cases these coordinators' civil defense duties may be "collateral," but large utilities are justified in appointing a full-time civil defense coordinator. He develops the company's civil defense program, including all the measures which would be placed in effect immediately upon the outbreak of war or when the international situation indicates that war is imminent.

Pre-attack Measures

The local utilities, working with the civil defense engineering services in the pre-attack period, make studies of the probable distributing systems. They determine existing weaknesses in their organizations, develop plans for changes, additions, or improvements required to place their utility under emergency operating conditions, and complete as many of the needed changes as practicable. Working closely with the local civil defense director, they might assume on air burst attack with one $2\frac{1}{2}$(X) bomb, accompained by high explosive bombing, that probable ground zero would be

(*Continued on page 46*)

Sprinkler

(*Continued from page 16*)

therefore is virtually free from defects due to aging.

One of the major problems encountered in the perfection of the sprinkler head was the necessity for designing valves and orifices that would not leak or stick after considerable periods of time. The use of metals with different coefficients of thermal expansion resulted in leaks in several cases, and rust and corrosion caused valves to become inoperable. Variations in water pressure further complicated the problem, since this pressure was depended upon to open the valves. To eliminate these problems, nozzles were re-designed in many sprinklers to include thin metal diaphragms with orifices in their centers. In some models, metal valve discs closed the orifices; these discs were held in place by the linkage arrangement mentioned earlier. A popular modern sprinkler uses a metal diaphragm with its orifice faced with hard solder to assure a tight joint with its hemispherical glass valve disc. Porcelain and hollow metal valve discs are also used.

Figure 3 shows a typical present-day sprinkler head which includes the stress reducing levers and the deflector. The lever arrangement holds the valve in place, and the leaves are secured by means of the soldered link. This link consists of two metal plates bent as shown in Figure 4, and held together with solder. At the center of the link the solder is in compression, thus reducing the possibility of separation due to cold flow of the solder. The solder is designed to melt at about 160° Fahrenheit for most applications.

By the second decade in the present century the automatic sprinkler head had been developed to the extent that little in the way of improving reliability could be suggested. The development of the device therefore stopped at about that time, and it is doubtful if any further improvements will be made. The test of time may show defects that cannot be predicted, but taken as a whole, the automatic sprinkler of today is an extremely reliable device.

● LEROY* Lettering equipment is standard in drafting rooms everywhere. No special skill is needed for perfect, regular lettering and symbol drawing. There are LEROY templates in a variety of alphabets and sizes, as well as for electrical, welding, map, geological, mathematical and other symbols that the draftsman needs. *Trade Mark®

KEUFFEL & ESSER CO.

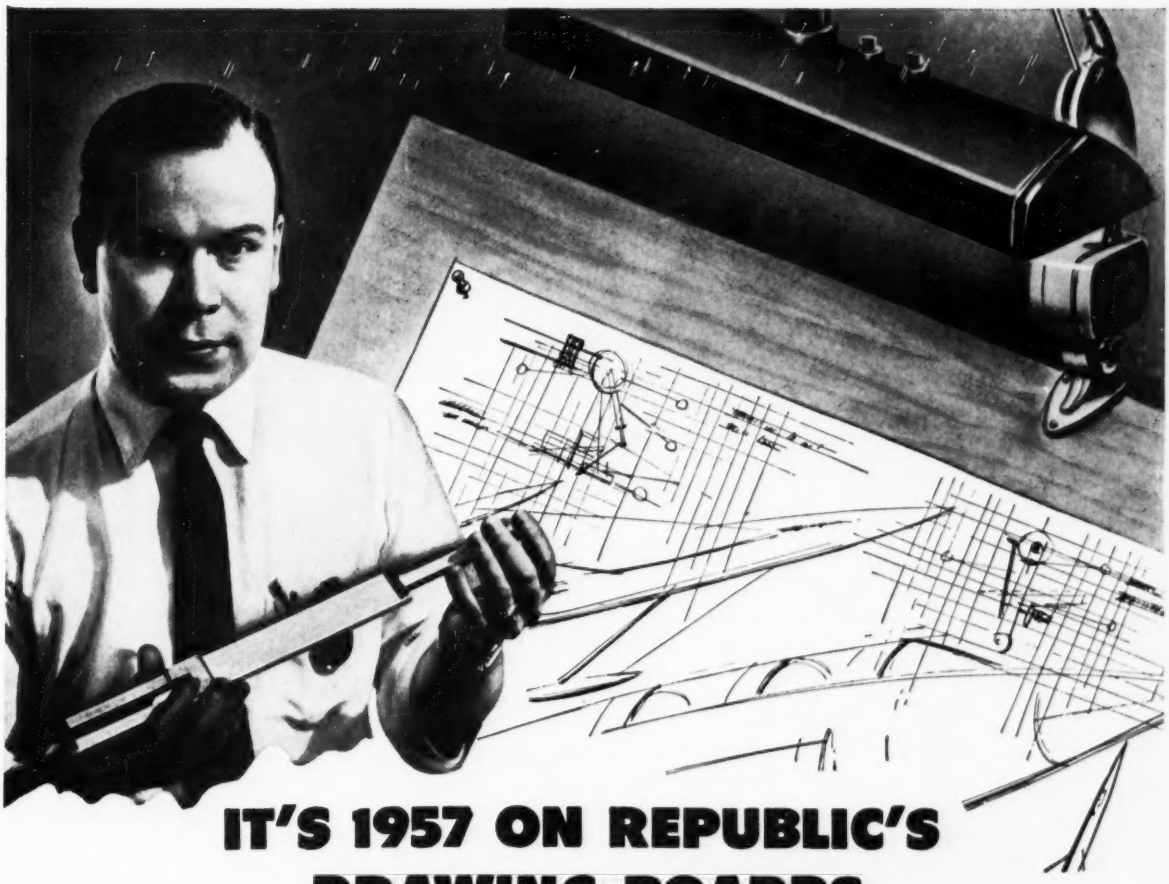
EST. 1867

NEW YORK • HOBOKEN, N. J.

Chicago • St. Louis • Detroit • San Francisco • Los Angeles • Montreal

K+E

Drafting, Reproduction and Surveying Equipment and Materials, Slide Rules, Measuring Tapes.



IT'S 1957 ON REPUBLIC'S DRAWING BOARDS

Visionary Young Engineers Work Years Ahead on Jet Fighter-Bomber Design...

There's drama on the drawing boards at Republic!

A great new jet fighter-bomber is being created, years ahead of its time. Like its famous predecessors, it will be the product of young men of vision, working in an atmosphere encouraging individual initiative.

For, Republic has long believed that its engineers are creative men who cannot be cast into a mold and still maintain the individuality and imagination that are the lifestream of aviation. At Republic, the ability and creativity of the engineer thrives on a diet of challenging assignments that permit him to probe and express new ideas.

This approach has been notably successful. Since 1931, Republic has been a leader in the aircraft industry, and today employs over 27,000 people, with an engineer ratio of 1 to 8. From the first all-metal plane to the famous Thunderbolts, Thunderjets, and Thunderstreaks, Republic planes have been pace-setters in aviation. And Republic engineers, sharing in this success, are at the peak of their profession, earning top pay in industry.

Republic engineers know, too, the pleasures of good living. Centrally located on Long Island, with its model suburban communities and abundance of year-round recreational facilities, Republic is less than an hour from New York City and its unparalleled cultural and entertainment attractions.

For further information concerning our training programs, which prepare graduate engineers for positions in aircraft engineering or manufacturing supervision, please write directly to your special Republic representative, Mr. Charles J. Ketson, Employment Manager.

REPUBLIC
AVIATION CORPORATION

Farmingdale, Long Island, New York

(*Continued from page* 44)

in the densely populated business district of the city. By placing a transparent overlay with concentric circles of ¾ mile intervals representing damage zones on their utility service area maps, they can note the probable extent of damage that would be inflicted on their plants and distribution systems. Starting with those basic assumptions, the utility companies evaluate the adequacy of their personnel, equipment, and supplies for meeting the emergency. Some of the major items they consider are: (1) maps and records, (2) communications, (3) alternate offices, (4) field headquarters and storage yards, (5) sources of supply, (6) distribution systems, (7) stocks of supplies and equipment, and (8) probable manpower needs. Each company prepares a comprehensive report to its management with recommendations for developing a complete utility program to function during emergency conditions.

Once the emergency program has been developed, arrangements are made for training the utility employees in the duties of their assigned positions to that they will know how to fit into the civil defense program and thus be able to take up their new assignments with a minimum of confusion or delay. Personnel assigned to the emergency organization receive basic first-aid training as well as instruction on the organization, purpose, and functions of civil defense generally.

Alternate Control Offices

The designation of alternate headquarters or control rooms to be used by utility executives, should their main offices be destroyed, is important. Arrangements are made in advance concerning space, personnel, furniture, communications, records, maps and map boards, and other essential items.

The determination of priorities for utility service in disaster is part of the pre-emergency planning. Hospitals, radio broadcasting stations, food storage and processing plants, transportation, municipal and government agencies, key industrial plants, mass care centers and other vital facilities necessarily receive higher priority ratings than facilities less important to the national defense and civilian economy.

A sound communications system is of the utmost importance, so plans are made to bridge possible gaps during the emergency with alternate wire, radio and messenger service.

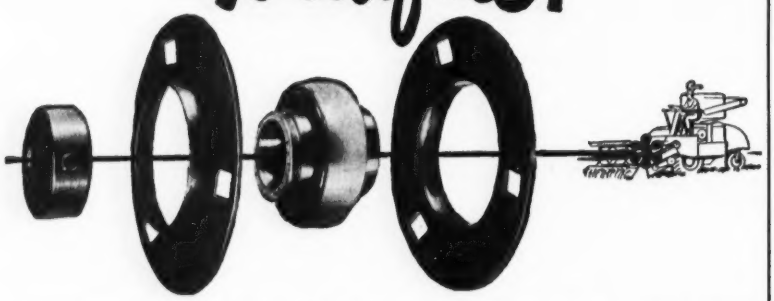
Consideration is given to feasible means of dispersion for repair equipment, supplies and tools, and for repair trucks and other vehicles which might be destroyed if housed at the same location. Increased stocks of the equipment, materials, and supplies most likely to be needed for emergency repairs are provided.

Steps are taken in the pre-attack period to provide a safe repository for all important maps and records that would be needed to continue operations or prevent large financial loss. If duplicate records are not already on file in some other locality, microfilming of these vital records is recommended. Finally, arrangements are made for imparting suitable publicity and information to the general public when occasion demands. Announcements are prepared in advance to notify citizens concerning service restoration progress and actions they should take to protect themselves meanwhile.

An operational plan is prepared in advance for each utility service in the city, and coordinated with the city's over-all emergency operational plan. The operational plan describes the action to be taken *automatically* upon the various warnings which may be expected, as well as at the time of attack. It describes the assumptions on which the plan is based (e.g., anticipated number, size, and type of A-bombs; probable location of ground zero; expected time of bombing; etc.), and states in general terms the plan for automatic operations. It includes detailed statements as to "who is to do what, and when, and how." After the plan has been prepared it is tested by rehearsals and test exercises, and every effort is made to improve the procedures initially prescribed.

END OF PART I

The idea that caught like *Wildfire!*



Many important improvements in the design and construction of farm machinery and equipment have been made possible by this low-cost, easy-to-install ball bearing unit. It simplifies construction . . . eliminates cost barriers . . . improves overall performance. As a result, the advantages of precision ball bearings are available on more turning points than ever before.

This popular development, the Fafnir Flangette, reflects the Fafnir "attitude and aptitude" . . . a way of looking at bearing problems from the manufacturer's viewpoint . . . an aptitude for supplying the *right* bearing to fit the need.

Available

A sound-motion picture depicting high points in the manufacture and use of Fafnir Ball Bearings is available to engineering classes. Write to The Fafnir Bearing Company, New Britain, Conn., for details.

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

William R. Parlett, Cornell '48, Sets Sights on Executive Sales Job

BILL PARLETT has learned that helpful engineering suggestions promote good customer relations.

"Within the next ten years", says William R. Parlett, young Worthington Sales Engineer, "many of the officers of the corporation, district office sales managers and top salesmen will be retired.

"Appreciating the fact that someone must fill these jobs, our management is striving to develop capable leadership among the younger men of the corporation.

"As a prospective Worthington Sales Engineer, I received several months of classroom instruction by works managers, top sales personnel and application engineers at all of the Worthington plants. The background I obtained was a sound basis for further development and learning gained in one of the product sales divisions and then in a district sales office. After obtaining sufficient product knowledge and sales training, I was ready to sell directly to industry. As more important sales assignments are available, I feel I will progress in proportion to my own development and sales performance.

"As a Worthington salesman I contact a class of trade with which it is a pleasure to do business. The company's reputation is a key to a welcome reception by my customers.

"I have found that with Worthington you have job satisfaction, adequate compensation, and unlimited opportunity."

When you're thinking of a good job, think *high*—think *Worthington.* 3.6

FOR ADDITIONAL INFORMATION, see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, N. J.

WORTHINGTON

The Sign of Value Around the World

STRESS and STRAIN...

Coed: "What's the difference between dancing and marching?"
Engineer: "I don't know."
Coed: "I didn't think you did. Let's sit down."

* * *

"My dad takes things apart to see why they won't go."
"So what?"
"You'd better go."

* * *

E.E.: How do you tell a male fish from a female fish?
Ch.E.: You add some hydrochloric acid to the tank. If he comes up to the top, it's a male. If she comes to the top it's a female.

* * *

Two engineering students were taking calculus for the first time and while waiting for the instructor to arrive, they took a quick perusal through the book. One of them came across some formulas at the back of the book.

"Tell me," one asked his friend, "can you read that?"

"No," replied his friend, "but if I had my flute with me I could play it."

* * *

The click of knitting needles, the creak of the rocker and the ticking of grandfather's clock were all that disturbed the silence of the room. With childish curiosity little Priscilla sat watching the purls and stitches.

"Why do you knit Grandma?" she asked.

"Oh, just for the hell of it," the old lady replied.

* * *

Two hipsters, in a museum spotted a bust of Julius Caesar. One said to the other, "This guy has been gone for two thousand years."

The other replied, "Crazy man, those Romans really knew how to live."

The lawyer had just given his girl a beautiful skunk coat.

"I don't see," she mused, "how such a nice coat can come from such a foul smelling beast."

"Well," replied the lawyer, "I don't ask for thanks, but I do demand a little respect."

* * *

A musician was practicing on his saxophone late at night when the landlord came in. "Do you know there's a little old lady sick upstairs?" asked the landlord.

"No," replied the musician. "Hum a little of it."

* * *

Textbook styles: "The puissance of hydrochloric acid is incontestable; however, the corrosive residue is inharmonious with metallic persistence."

ChE. style: "Hydrochloric acid eats the hell out of steel.

* * *

On his first solo run, the engineer brought the train to a screaming halt just short of a tunnel.

The brakeman noted his trembling hands, and queried, "What's the trouble, Mac? Is there something wrong with that tunnel?"

"I may be new at this," replied the engineer, "but any fool can see that this big train could never get through that tiny hole at the other end of this tunnel!"

* * *

Little girl to her mother: "Will I walk to heaven on a golden bridge —The minister said so."

"He's wrong dear, there are no bridges in Heaven—it takes engineers to build bridges."

* * *

Jim (from back of room): "Are you sure that this third test question is in the book?"

Professor: "Certainly it is."

Jim: "Well, I can't find it."

Hulbert: "You say your friend was drowned while you were in Italy?"

Oscar: "Yes, he got into a street fight in Venice."

* * *

For years the bum slept under bridges and in ditches. Then one day he switched to culverts and became a man of distinction.

* * *

M.E.: "Going around a lot with women keeps you young."

2nd M.E.: "Why's that?"

M.E.: "I started going around with women when I was a freshman two years ago, and I'm still a freshman."

* * *

Through the smoke and ozone
fumes the student slowly rises;
His hair is singed, his face is black,
his partner he despises;
He shakes his head and says to him
with words so softly spoken,
"The last thing that you said to me
was: Sure, the switch is open.' "

* * *

Nurse: "I think he's recovering consciousness doctor—he's trying to blow the foam off his medicine."

* * *

One Aggie: Whar ya from?

Another Aggie: Philomath, Oregon.

One More Aggie: One of those there towns where everybody goes out to meet the train?

Another: Train?

* * *

Professor: "Young man, do you know who I am?"

Freshman: "No sir, but if you remember your address, I'll take you home."

* * *

Governor, looking at newly-constructed WPA dam: "Migawd, the water! It's supposed to be on the other side!"

Richmond Station of the Philadelphia Electric Co.

Weeks of work shrink to days as

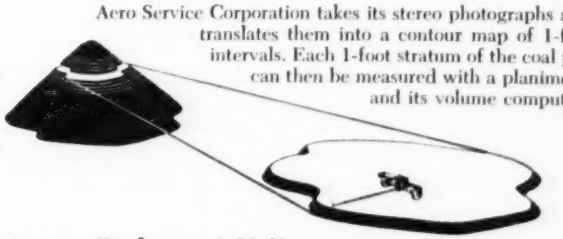
photography weighs mountains of coal

Aero Service Corporation takes stereo pictures of the coal piles at a utility's 10 storage sites—reports the fuel reserves on a single inventory date at 25% lower cost than with other methods

It used to take a surveying crew weeks to measure and figure the contents of the Philadelphia Electric Co.'s big coal piles. Now a camera and an airplane work together to cut the time to days. Overlapping pictures are taken from the air. Then with stereo plotting equipment the volume of the heap is calculated.

Streamlining the inventory job is a natural for photography. It's being used to count metal rods, automotive parts, telephone calls as well as tons of coal. But photography works for business in many other ways as well—saving time, reducing error, cutting costs, improving production.

Graduates in the physical sciences and in engineering find photography an increasingly valuable tool in their new occupations. Its expanding use has also created many challenging opportunities at Kodak, especially in the development of large-scale chemical processes and the design of complex precision mechanical-electronic equipment. Whether you are a recent graduate or a qualified returning service man, if you are interested in these opportunities, write to Business & Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.



Aero Service Corporation takes its stereo photographs and translates them into a contour map of 1-foot intervals. Each 1-foot stratum of the coal pile can then be measured with a planimeter and its volume computed.

Eastman Kodak Company, Rochester 4, N. Y.

ENGINEERS HERE'S AN

Invitation To Success . . .

GENERAL ELECTRIC'S

SALES ENGINEERING PROGRAM

Opening the doors to challenging careers—as SALES ENGINEERS—APPLICATION ENGINEERS—PRODUCT SPECIALISTS—G.E.'s Sales Engineering Program is an invitation to success to all young engineers who want to combine engineering know-how with contact work . . . who want a career that is varied, challenging . . . who want long-range advancement opportunities limited only by individual performance.

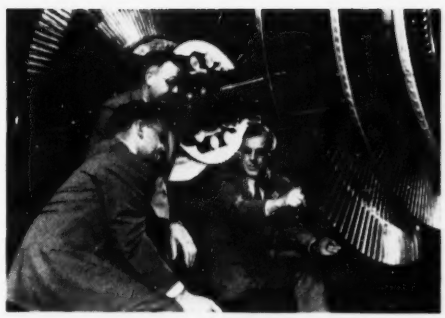
ON-THE-JOB EXPERIENCE . . . provides you with outstanding training in industry sales techniques, market characteristics, sales plans and policies, product engineering work, industry engineering.

- as a *Sales Engineer* you will learn from some of the nation's finest industrial salesmen.
- as a *Product Specialist* you will work with some of the most ingenious men in the electrical industry.
- as an *Application Engineer* you will learn how to solve intricate customer problems from some of the most experienced men in the field.

INTEGRATED CLASSWORK COURSES . . . are designed to give you information for good daily job performance and a sound background for positions of greater responsibility. Courses in sales methods, apparatus marketing, business fundamentals, etc., supplement your on-the-job experience and provide excellent advancement opportunities.

COMPLETING THE PROGRAM . . . means you may go to one of G.E.'s many Districts—with sales offices in 152 key cities in 45 states. Or you may prefer assignment to a headquarters operation. Regardless of your choice, you will be working with some of the most competent men in industry in an interesting, fast-moving career—and you will be building your career with the leader of the fastest growing industry in America!

For more information see your college placement officer or write:
College Editor
Dept. 2-123
General Electric Co.
Schenectady 5, N. Y.



A Sales Program man learns how good design makes sales easier.

As a specialty salesman you'll have a chance to work with young companies, to help them grow to be leaders in their field.

On-the-job training in design or commercial sections gives excellent opportunity to learn engineering, application, marketing of G.E. apparatus products.

GENERAL ELECTRIC